SCIENTIFIC AMERICAN

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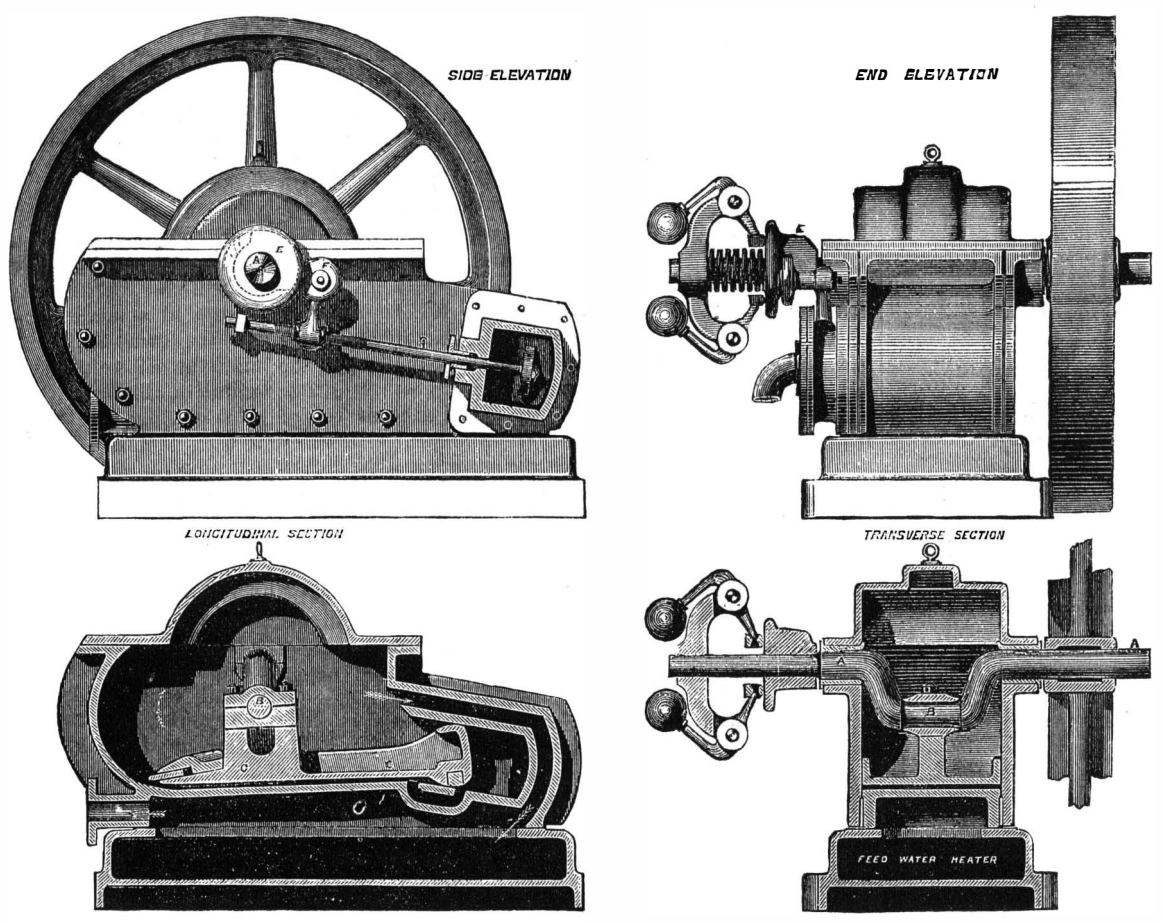
A SEMI-ROTARY ENGINE.

If anybody should ever apply the development theory of creation to steam engines, the apparatus represented in the engraving herewith annexed would doubtless be hailed as the connecting link between rotative and rotary machines. It certainly is a curious hybrid; it is a reciprocating machine, and yet it is not wholly so, nor is it exactly a rotary; perhaps the inventor's name for it, as above stated, is the best, after all, that could be devised. Its construction and operation will be easily understood from the illustrations, which we take from the *Engineer*.

A is the crank shaft, B the crank pin, C the piston, D the valve, E the cam, F the cam wheel, G the valve spindle, and H the supply pipe. The steam is admitted on the face of the piston, through the valve, which, as shown in the side elevation, is worked by the cam, E. The piston then travels in the direction of the arrow, first ahead, then up, down, and back. The governor is so arranged that full boiler pressure is always admitted.

The advantages claimed are (over the ordinary piston engine) reduced cost, it occupies less than half the space, it is governed expansively in an efficient manner, and there are few wearing parts. It is the invention of Mr. Andrew Higginson, of Liverpool, England.



HIGGINSON'S SEMI-ROTARY ENGINE.

A New Flooring.

A new system of parquet flooring has recently been introduced in France by M. Buffaut The squares are composed of slips of wood made in patterns. The pieces are held together by a layer of bituminous cement laid hot on their under side, and this cement is, in turn, covered with a paving tile, so that the three substances are intimately united. Conical pins are driven through holes left in the tiles and into the wood, while the cement is still in a liquid state. The squares are laid in mortar or cement over a layer of sand, and are joined together by very fine iron tongues fitting in grooves. This system is applicable where marble and ordinary pavements are employed, and may be also applied to cabinet work.

IMPROVED CONTROLLING NOZZLE.

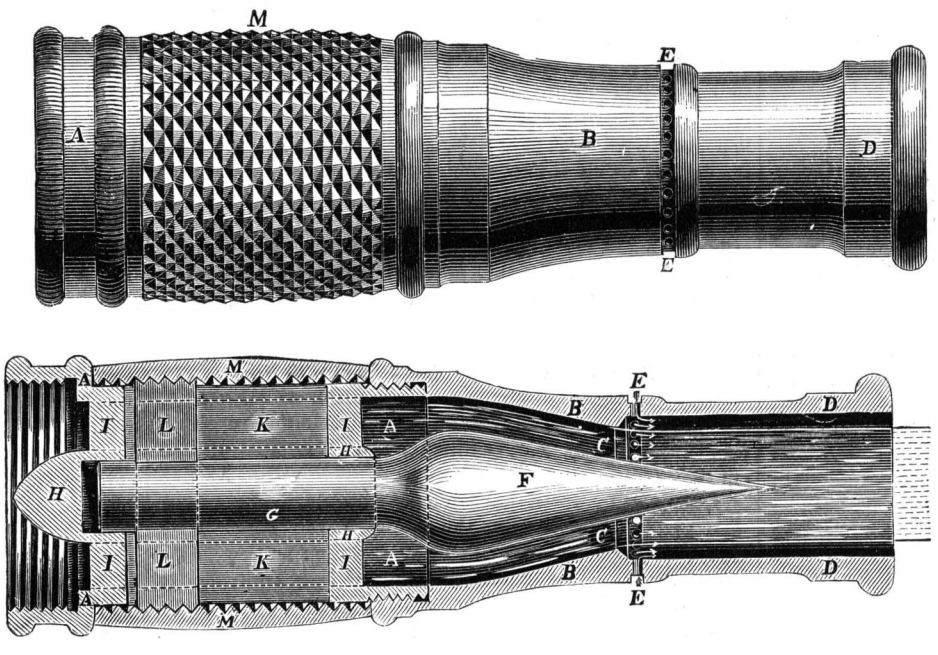
We illustrate herewith an improved nozzle, adapted to fire extinguishing apparatus and for other purposes, whereby the size of the stream, and consequently the volume of water projected, may be easily controlled, or the jet be altogether shut off. There are many advantages attending this arrangement, which will suggest themselves to all conversant with the demerits of the ordinary nozzles. Perhaps the most important advantage (and the one that will especially commend itself to insurance companies) is that the device is calculated to prevent the indiscriminate flooding of warehouses, and the consequent large damage, by water, to buildings and to valuable stock. The reduced stream suffers no diminution of force, and can be thrown as far as, if not farther than, a jet projected from a common plain or ring nozzle. Consequently, in small fires, the quantity of water necessary for their extinguishment can be applied, and any surplus drenching avoided. The controlling mechanism opens and closes the nozzle very uniformly and gradually, so as to avoid the shock due to sudden starts or stoppages of the water. The hose is thus prevented from bursting, while the apparatus is rendered safe for use on hose or hydrants carrying high pressures, and on hose connected to fire engines equipped with relief valves. Greater facility is also afforded in handling hose, by closing down the nozzle and reducing or cutting off the back thrust of the stream.

An exterior and a sectional view of the invention are given in the annexed engravings. The nozzle barrel, A, is screwed into an end piece, B, which has its discharge orifice, C, opening into a valve guard tube, D, in which are air inlet holes, E. A long pointed cone valve, F, placed concentrically with the nozzle, has its stem, G, accurately fitted, but free to move in a small tube, H, which is supported by two thin feather-edged wings, I, fixed transversely in the barrel. A long narrow slot, K, is formed through the wings and barrel, in which slot traverses a flat bar, L, which is fixed to the valve stem. Said bar has rack teeth on its ends, which engage the screw threads of a milled sleeve, M, which revolves freely on the barrel, A, and which moves the cone valve out and in from its seat at the discharge orifice, to regulate the size of the stream or to shut off the same. The water forms on the cone a solid round jet, which does not fill or touch the tube, D. A spraying attachment (not shown in the engravings) is made by placing in the outer end of the tube, D, a disk perforated with divergent holes, which is secured in place by a suitable cap. When this disk is placed in one position it throws a spray, and when it is turned over it throws a solid stream, in both cases backing the water up in the tube, D, and making a rear spray from the holes, E, which protects the pipeman from smoke and heat.

The nozzles are made in three sizes, respectively of capacity to throw a stream of 1⅛ inches, 1 inch, and ¾ inch in diameter. These are adapted to all requirements, including those of hotels, warehouses, factories, steamships, etc., up to the largest pumping engines, and are likewise capable of throwing jets as small as ¼ inch.

The inventor, Mr. Melville Clemens, of Worcester, Mass., submits a large number of testimonials from the chiefs of the Fire Departments of New York, Philadelphia, Worcester, Holyoke, Mass., and other cities, pump manufacturers, and others, all of which indicate that the device is both useful and efficient.

Patented March 14, 1876. Patents applied for abroad and in Canada. For further information and circulars, address the manufacturers, the Eaton, Cole, and Burnham Company, 58 John street, New York city.



THE CLEMENS CONTROLLING NOZZLE.

Cinnamon and Cloves.

The cinnamon of commerce is the inner bark of a tree closely resembling the laurel, or sweet bay, a native originally of Ceylon, but which is now grown in the other parts of the East Indies, and also in Jamaica and other West India islands. The trees are left to grow unmolested until they are nine years old, at which time the young shoots or branches that are about three years old are lopped off. The bark is then slit on one side and removed from the branch, tied up in bundles until the next day, when it is loosened, and the skin or outer bark scraped off. It is then dried or rolled up into quills or pipes, about three feet long, which have a slit down one side, where the bark was cut. The smallest quills are rolled up inside the larger; the whole then tied up in bundles of 80 or 90 lbs. weight, and wrapped up in cloths, when they are ready for exportation. It has an astringent and highly aromatic and warm flavor, and yields by distillation an extremely fragrant and pungent volatile oil, kept for pharmaceutical use under the name of oil of cinnamon.

The articles known in commerce as cloves are the unopened flowers of a small evergreen that resembles in appearance the laurel or the bay. It is a native of the Molucca or Spice Islands, but has been carried to all the warmer parts of the world, and is largely cultivated in the tropical regions of America. The flowers are small in size, and grow in large numbers in clusters at the very ends of the branches. The cloves we use are the flowers gathered before they are opened, and while they are still green. After being gathered, they are smoked by a wood fire, and then dried in the sun. Each clove consists of two parts, a round head (which is the four petals or leaves of the flower rolled up, inclosing a number of small stalks or filaments), the other part of the clove being terminated with four points; it is, in fact, the flower cup and the unripe seed vessel. All these parts may be distinctly shown if a few cloves are soaked for a short time in hot water, when the leaves of the flowers soften and readily unroll. The smell of cloves is very strong and aromatic. Their taste is pungent, acrid, and lasting. Both the taste and smell depend on the quality of oil they contain. Sometimes the oil is separated from the cloves before they are sold, and the color and taste in consequence are much weakened by this proceeding.

A SIMPLE way of cutting glass is to crack it with a very fine needle-like gas flame. Start the crack with a file, and then apply the flame, which may be produced through a minute perforation in a glass connected with some rubber piping so as to allow of the flame being conveniently carried from point to point. The crack will run before the flame in any desired direction.

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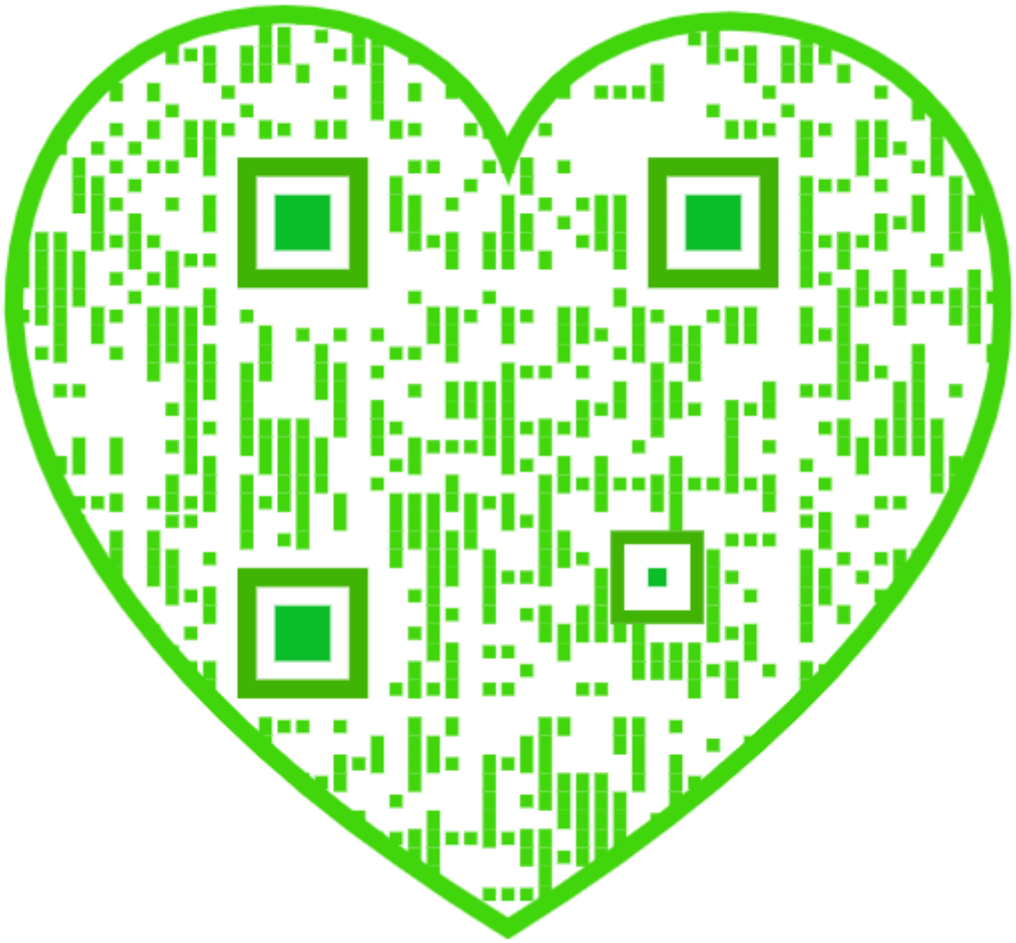

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NEW YORK, SATURDAY, APRIL 8, 1876

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THE CENTENNIAL EXPOSITION AS AN ELEMENT IN THE DEVELOPMENT OF OUR MANUFACTURING INTERESTS

There can be reasonable doubt that the United States is about to assume a new and important position as a manufacturing nation. But a few short years ago, we were known as an agricultural country, having vast mineral resources lying idle and unproductive. Our imports of the various metals and of manufactured goods were something enormous; we have just emerged from a war unsurpassed in its expenditure of human life, money, and national substance, a war in which the whole losses of both sides fell upon one nation and people; and yet since the close of that conflict, we have made our *debût* as a manufacturing people and maintained a rate of progress hitherto unparalleled in the history of nations. To this fact more than to any other will the Centennial Exposition point. Of the 60 acres of ground covered by the exhibition buildings, only about 12 acres are devoted to agricultural and horticultural pursuits, while there are 14 acres devoted to the products of machinery alone. Time will probably show that the markets of the world will be opened to American manufacturers, and the Centennial Exposition will do much to bring the demand for our mineral and manufactured products in direct contact with the supply. The more we examine into this view of our subject, the more impressive it becomes.

During the last decade, the prices of our raw material and labor have ruled exceedingly high; and yet we have driven foreign steel from our markets Our imports of cotton and of nearly all other manufactured goods are largely and continuously on the decrease. At the present time, our cost of production is diminishing by cheapness of labor. We are steadily grasping the edge tool trade. Our cast iron is forcing its way as the best yet produced, and the inventive power and intelligence of our mechanics are universally recognized. We are about to repeat the experience of the older nations. During an era of high prices, we developed our mineral resources and learned to manufacture high class goods, and to spin and weave our own products; but the comparatively high price of our labor and other similar causes excluded us from entering the competitive markets of the world. Fortunately for us, there has set in, with every prospect of a continuance, an era of diminution of the values of both material and labor, which will enable us to tender our goods in markets other than our own; and more fortunately still, the Centennial Exposition steps in and brings the purchaser to inspect our goods.

This is the first instance, in the history of the six great international exhibitions of the last 25 years, in which the question of the comparative cost of productions has been largely considered or mooted in an international sense. Never before have the representatives of national industries debated the questions of comparative cost of production, of affixing to exhibited articles their prices, of the propriety of competing unless such prices were affixed, and of the questionable policy of putting on exhibition products of manufacture, lest the nation mainly interested in such should gather information and ideas rendering them still more formidable as competitors in the world's markets. These are the facts which evidence the existence of a feeling that the Centennial will become the means through which new channels of trade are to be opened up, and long established markets are to be closed; and through which, while new customers are to be found, old ones are to be certainly lost.

Among the branches of American trade to be the most largely benefited, we may doubtless mention the iron, steel, machine, edge tool, saw, agricultural implement, woodworking machinery, general and special tool, timber, and cotton manufacturing industries. Nor will the intelligent foreign visitor fail to perceive that our remarkable progress in manufactures is largely due to the comparative liberality of our patent laws, and the encouragement given to inventors through the progressive character of our people. That the number of visitors to the exhibition will be large, the traveling propensities of Americans are probably a sufficient guarantee: that the attendance of the business community will be proportionately larger than at any previous international exhibition, there is every reason to presume, for the reason that competition is here unusually close. Every tradesman considers it his duty to be "posted" as to his competitor's goods and facilities to carry on his business; the "drummer," as our genus of the commercial traveler is facetiously termed, is a profuse American institution; while an American housewife scarcely makes a purchase without having priced the desired article at two or more stores.

We are convinced that the honors in the shape of awards will be eagerly sought, and that their possession will largely influence many branches of trade; while the benefits to be bestowed upon us by this peaceful industrial monument, erected to the Centennial of our national existence, are at present almost incalculable.

BAD VENTILATION AT THE CAPITOL

If the dozen or so of Congressmen now sick with throat disease shall serve, even in a moderate degree, to impress upon the people the evils of bad ventilation and of vitiated air, our afflicted legislators will not have suffered in vain. As martyrs, they will perhaps have done the country better service than as law makers. But the wretched ventilation of the House of Representatives is no new thing; neither is the foul atmosphere in the public schools of New York, though the existence of both sources of peril is once more being prominently brought into public notice by the daily papers. Poisoning the innocent pupil on one hand, and smothering the statesman on the other, are standing national abuses which, it might be argued, are only to be remedied by the slow alteration of public sentiment; but as abuses, they are superfluously glaring, and, by such examples as the present being brought into daylight, it is to be hoped that the full extent of their dangers can be rendered so apparent as to show the folly and culpability of neglecting the precautions necessary to avoid them. Carbonic acid is the product of perfect combustion and of the breathing of animals, the oxygen in the latter case uniting with carbon in the system; and the air expired contains about 4½ per cent of carbonic acid gas. This, if confined, contaminates the pure air in the room to such an extent that, if an atmosphere, containing one two-hundredth of it be breathed, headache and lassitude result. This, however, is not fatal, as air mixed with 5 or 6 per cent of the deadly gas may be safely breathed; but an atmosphere of 25 per cent carbonic acid is deadly. Children breathe about 14 cubic feet of air per hour, and this, when exhaled, contains 430 times the normal amount of carbonic acid; and so swift a poison does the air then become that if 100 persons were confined in a room, 18 feet square by 11 feet high, in which there was no ventilation, within two and a half hours every individual would be dead. Therefore, when people of sedentary occupations become afflicted with headaches and sore throats, and it is known that they habitually exist in a foul atmosphere, it is as safe to assert that they are being slowly poisoned as it would be had they contracted the opium or any other injurious habit. But to this source of danger must be added another: It appears that the ventilating arrangement of the House of Representatives is such that the cold air sweeps down upon the floor, and thus forces upon the members the foul atmosphere, generated by the gas burners and by the occupants of the galleries. The fresh air supply is taken in through the basement into the cellar, and is then forced up by fans through iron pipes, which, it is said, are "coated by many years accumulation of rust and particles of decaying animal and vegetable matter." From these the current goes through a series of horizontal air ducts, and finally, at a temperature of 100° or thereabouts, is driven into the chamber through registers, which for years have filled the office of spittoons. It is further reported that the mouth of the sewer which drains the Capitol is submerged, so that from every sink there is an escape of sewer gas into the building. Under this condition of affairs, there is no cause for wonder that those who occupy the House should complain.

AFRICAN RUBBER.

The coast region north and south of the Congo is becoming quite an important source of caoutchouc. It is produced by a giant tree creeper (*landolphia*), which grows principally along the water courses. It covers the highest trees, and frequently considerable extents of forest are festooned down to the ground, from tree to tree, in all directions with its thick stems, like great hawsers. Sometimes its stem is as thick as a man's thigh. Above, the trees are nearly hidden with its large glossy leaves of dark green hue, and studded with beautiful bunches of pure white star-like flowers, most sweetly scented. Its fruit is of the size of a large orange, yellow when ripe, and perfectly round, with a hard brittle shell; inside it is full of a soft reddish pulp of an agreeable acid flavor, much liked by the natives. It is not easy to obtain ripe seeds, as the creeper is a favorite resort of a villanous, semi-transparent, long-legged red ant—with a stinging bite, like the prick of a red hot needle—which is very fond of the pulp and the seeds distributed through it.

Every part of the creeper yields a milky juice when wounded; but, unlike the juice of the American rubber tree, this milky sap will not run into a vessel placed to receive it. It dries so quickly that a ridge is soon formed over a cut, and the flow arrested. When collecting it, the natives make long cuts in the bark with a knife, and as the sap gushes out they wipe it off continually with their fingers and smear it on their arms, shoulders, and breasts, until a thick covering is formed. Then they peel it off and cut it into small squares for transportation.

A COPPER-BEARING BIRD.

One of the most interesting of the West African birds is the plaintain eater, *corythaix paulina*, found abundantly in the thick forests of Angola. By the natives these birds are regarded with superstitious reverence, due apparently to their loud, hoarse, unbirdlike cry, which is of such evil omen that, if uttered within the limits of a town, the place is immediately abandoned. They are sometimes brought from the interior to the coast for sale, but the carriers are not permitted to bring them into towns along the road.

It is a remarkable characteristic of this bird that the gorgeous blood-red color of its wing feathers is soluble, especially in a weak solution of ammonia, and that the soluble coloring matter contains a notable quantity of copper. By burning the smallest portion of a feather in a Bunsen burner, the presence of copper is clearly manifested. By transmitted light, the ammoniacal solution is of a magnificent ruby red color. From a bunch of 300 feathers brought from Sierra Leone by J. J. Monteiro, about 16 grains of turacin was obtained by Mr. Henry Bassett, who reports that two copper determinations gave quantities of oxide of copper corresponding to 7·6 and 8·0 per cent of metallic copper. From an earlier investigation, Professor Church found 6 per cent of copper. Mr. Monteiro reports that the copper is derived from particles of malachite, so universally distributed over Angola, the habits of the birds seeming to favor this, as they are extremely inquisitive in their wild state, and given to picking up bright objects. On the other hand, he has known them to moult regularly and reproduce their splendidly colored feathers when kept in confinement where copper could by no means enter into their diet, except what might be con-

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tained in fruit, rice, bread, biscuits, and vegetables, their customary food in the absence of their favorite bananas.

A specimen of an allied species, *c. Livingstonii*, was brought to England by Mr. Monteiro, who describes it as beautifully tame and gentle. It was most amusing in its habits and in the notice it took of everything around it. A change of dress, or even a new ribbon, excited its attention greatly. It would utter a loud cry and open out its lovely wings in astonishment, and, coming close to the bars of its cage, examine the new decoration with the liveliest curiosity. It was very fond of looking at pictures, especially brightly colored prints. At night it roosted in a little flat basket, in which it showed a child-like reluctance to nestle until it was sung to for a few minutes, when it would utter a satisfied sort of low rumbling noise, squat down, and go quietly to sleep.

The wild birds display their observing and extremely inquisitive disposition by running along the large branches of the trees in an excited and fussy manner, with outstretched neck and expanded wings, peering down on any intruder with every expression of interest. The natives believe that these demonstrations are intended to give travelers warning of danger from wild beasts and robbers.

THE COST OF MOTHS AND MILDEW.

A very striking illustration of the value which often attaches to a patent for a comparatively small invention, especially when the introduction of the same is skilfully managed, may be found in the large sums paid by our government for the use of a process for preventing moth and mildew in army clothing. The aggregate amount made thus far by the fortunate inventors, we do not exactly know; but in the Quartermaster General's report for 1874, the following passage occurs: "The expenditures on account of the moth and mildew proof process of Cowles & Co., during the fiscal year, have been $350,000. This includes $200,000 appropriated for the current fiscal year, but made available for expenditure during the last fiscal year." To prepare articles not yet treated, an additional appropriation of $100,000 is asked; but this subsequently was cut down in Congress to $50,000. The patent was granted, September 20, 1864, to George A. Cowles, Jesse P. Case, and Victor Vieron, of New York city, and is based on the preservative action of sulphate of copper on vegetable fibers. By the addition of alum, the preserving qualities of the mixture are, it is claimed, greatly enhanced; and when gelatin is also combined, the fibers are said to be not only proof against decay, but also impervious to water. The ingredients are: Alum, 2 lbs., dissolved in 60 lbs. of water; blue vitriol, 2 lbs., dissolved in 8 lbs. of water; to which is added gelatin, 1 lb., in 30 lbs. of water. A still further improvement is said to be effected by acetate of lead, ½ lb., dissolved in 30 lbs. of water. The solutions are all hot, and separately mixed, with the exception of the vitriol, which is added cold.

The circumstances attending the adoption of, and the continued royalty paid for, this process, are soon, we learn, to be made the subject of Congressional investigation, it being alleged that the compound is valueless as a preservative, and that some officials have acted fraudulently with regard to it. Whether these charges are substantiated or not, the fact nevertheless remains that the government is out of pocket some $400,000, and that the patentees or managers of patents are the gainers of a very large sum of money. The actual value of a process which will effectually destroy moth and prevent mildew in cotton or woolen goods would be great, even if the particular process now in question proved worthless. The simple fact of such large amounts having been paid for the use of the patented process in a single article conveys some idea of what may be realized by the inventor of any other process for like purposes which can be proved to be really efficient, especially if he be lucky enough to find in the government so liberal a patron.

THE POWER OF BOILERS.

Our readers must have observed the many questions on this subject that occur in our correspondence columns; and it may have seemed curious to them that, while nearly every manufacturer talks of the horse power of his boilers, we have invariably replied that we were unable to define the term, or furnish any standard rules relating to it. We think, however, that we can give good reasons for the position that we have assumed. It is evident that, if we wish to measure anything, we must have some unit of comparison in which the measurement may be expressed. It is easy to determine the length of a piece of cloth in inches or yards, because these are standard units, fixed by law. But if every manufacturer of cloth used a measure of his own which he called at pleasure a yard or an inch, without regard to its actual length, it is clear that a general expression like two yards of cloth would not have any definite meaning; and if we wished to speak of yards, it would be necessary to specify what particular yards were meant: so that it might be said, for instance, that 5 of Mr. A's. yards of cloth were the same as 10 of Mr. B's. We shall show directly that this is about the way in which we have to compare boilers rated by different makers. Any one who has looked over the catalogues of steam engine builders has doubtless noticed that different makers do not have the same idea about horse power; so that an engine may be rated in one list as 5 horse power, while another maker may rate one of the same size at 10 horse power. Fortunately, the term horse power, as applied to a steam engine, has an arbitrary meaning; and if an engine is sold under the guarantee that it shall develope a certain amount of useful horse power, all engineers will agree upon the meaning of the guarantee. When there was little difference in the details of engines, it usually happened that a boiler large enough to furnish one engine with steam would answer for any engine of the same dimensions; and as each of these engines would develope about the same amount of power, it was usual to speak of a boiler as being of such a horse power, meaning thereby that it would furnish steam for an engine of that horse power. Having found by experiment the proper size of boilers for engines of different dimensions, the builders were enabled to construct empirical rules, and to say that, for each horse power that the engine was to develope, a certain weight or volume of water must be evaporated by the boiler per hour, requiring a definite amount of heating and grate surface. In those days, a boiler of 10 horse power, for instance, was one that would furnish steam for a 10 horse engine; and as the performance of such engines varied but little, the term had a tolerably definite meaning. In the course of time, as improvements were introduced, it was found that the size of a boiler was not always a measure of its efficiency, and that different engines were operated with widely varying measures of economy. It became common, also, to employ boilers for such purposes as heating, in which it was difficult to estimate the effect in horse power. Another disturbing cause arose from the fact that, as the demand for machinery extended and new manufactories were started, under the competition of the trade it was not uncommon for makers to change the old rating, so as to induce their customers to believe that they were getting more for their money. Now if Mr. Smith, who keeps a dry goods store, were to assume that a yard was only 2 feet, and offer to sell 12 yards of calico for the same price that Mr. Jones, who uses a standard yard stick, asks for 8 yards, very few people would be imposed upon, and probably an inspector would make things unpleasant for Mr. Smith. But it is very common for Mr. Robinson, who is a boiler maker, to decide that 10 feet of heating surface per horse power is a good proportion for a boiler, and offer a 15 horse power boiler for the same price as Mr. Brown's 10 horse boiler, which has 15 feet of heating surface per horse power. If any one will compare a few price lists of boilers, he will find just such anomalies as this; and will probably conclude that the size of a boiler will not enable him to express its power, for the reason that he has no standard by which to measure it. If he extend his inquiries a little farther, he will find engines developing precisely the same power, but requiring boilers of very different size and efficiency, for the reason that one engine may be much more economical than another. Experience shows, for instance, that there are some engines which require the evaporation of more than 100 lbs. of water per hour for each horse power, while others need less than 20, which sufficiently demonstrates the impossibility of rating the standard power of a boiler by connecting it to any engine, taken at pleasure, and measuring the horse power developed. It is evidently unfair to make a good boiler suffer for the faults of a wasteful engine—and the number of engineers supporting our view of the matter is daily on the increase—this view, briefly expressed, being that the proper method of estimating the power of a boiler is to measure the quantity of water which it can evaporate in a given time, as, for instance, an hour. Now if feed water is supplied to one boiler at a temperature of 60°, and the steam pressure is 100 lbs. per square inch, while the feed water of another boiler is 120°, and the steam pressure only 50 lbs., a pound of water evaporated in the first boiler must have more heat imparted to it than a pound in the second boiler. In a third boiler it may be still different; and in order to make a fair comparison between different boilers under various circumstances, it is necessary to reduce the evaporation of each to a common standard, the standard usually chosen being the equivalent evaporation that would have taken place if the temperature of the feed had been 212°, and the pressure of the steam the same as that of the atmosphere. A simple manner of making this reduction was explained a short time ago in the SCIENTIFIC AMERICAN (page 225, volume XXXIII). In measuring the evaporation of any given boiler, it is to be remembered that in some boilers water is carried over with the steam; and unless its amount is determined, the evaporation will be overestimated. A purchaser who buys a boiler measured on the basis of its actual performance knows exactly what he is getting for his money; but it seems desirable to many that some unit should be fixed upon, so that the performance can be expressed in horse power. Such a rating would undoubtedly be convenient in many respects; and the value of the unit does not appear to be a matter of much importance, but it seems difficult for engineers to come to an agreement in this respect. A few years ago a committee was appointed by the Franklin Institute to fix upon a standard for the horse power of a boiler. After long deliberation, they presented two reports. All the members of the committee agreed that the true measure of a boiler's power was its actual performance, or its equivalent evaporation of dry steam, from and at 212°. A portion of the committee considered that the proper measure of a horse power was the equivalent evaporation of one cubic foot of water per hour, while the remainder stated that they were unable to agree upon any standard. The report of this committee contains much valuable information in regard to the practice of different makers in proportioning boilers.

The most recent publication upon the horse power of boilers is a little pamphlet by Mr. Nystrom, which has already been briefly noticed in our columns. Mr. Nystrom claims to have established the legal definition of the horse power of a boiler, because his explanation is in accordance with the law of dynamics, and is not contrary to the law of the land. Without discussing this point, it is sufficient to say that Mr. Nystrom's definition, however legal it may be from his point of view, is certainly not legalized, and consequently only adds one more to the assumed standards, which are already too numerous and confusing. His method may be briefly illustrated as follows:

A cubic foot of water, when evaporated, forms a definite volume of steam, corresponding to the pressure; and if we take the product of: 1. The number of cubic feet of water evaporated per hour. 2. The increase of volume of each cubic foot of water, by its conversion into steam. 3. The pressure of the steam, in lbs. per square foot: and divide this product by 1,980,000, the quotient, which is the greatest power this steam can develope in a non-condensing engine, without expansion, is the horse power of the boiler. Suppose, for example, that a boiler evaporates 25 cubic feet of water per hour, and that the pressure of the steam above the atmosphere is 130 lbs. per square inch, or 18,720 lbs. per square foot. The relative volume of steam of this pressure is 192·83, so that the increase of volume for each cubic foot of water, on its conversion into steam, is 191·83 cubic feet, and the horse power of the boiler is the product of 25,191·83, and 18,720 divided by 1,980,000, or 45·3+.

Mr. Nystrom gives a formula for reducing the observed evaporation to equivalent evaporation from feed water at 32°. He states, as we understand him, that the correct determination of the quality of the steam is impossible in the present state of our knowledge, and consequently his rule is defective, basing the rating of a boiler upon its apparent evaporation, uncorrected for priming or superheating. Of course engineers who think that they are able to make these corrections can readily introduce them into Mr. Nystrom's formulas; but they will probably find that the method previously stated, of basing estimates of power upon the equivalent evaporation from and at 212°, is preferable, on many accounts.

THE PAY OF THE PATENT BUREAU.

The policy of reducing the salary of office holders, generally, which has occupied considerable attention in our present Congress, we do not intend to discuss; but we agree with the sentiments of a Washington correspondent of the New York *Tribune* in the opinion that a generous policy should be pursued by Congress toward the Patent Office, which not only is self-supporting, but has acquired a large surplus fund. The inventors pay all the expenses of this department; it costs the government nothing to run it; and it would be poor policy to reduce the expenses attending its management if inferior talent is to take the place of the present efficient Commissioner and his force of assistants, which will be the natural result. Inventors were never more active than now; and it would be a bad commentary on our Centennial year if any steps should be taken to lessen the enthusiasm of our great body of inventors, to whom is due so much of our nation's progress.

R. H. Duell, Commissioner of Patents, thinks, states the same correspondent, that it will be very unwise to cut down the expenses of a self-sustaining bureau like his. He says that the United States Patent Office has long had a large annual surplus, that its business is increasing, and that there is no reason apparent for reducing either the number or pay of its officers. "The work of the office requires special training; even with the present pay, it is not possible long to keep in government employ many of those best fitted by talent and experience for the duty; the credit of the office and the interest of inventors, whose money supports the office, and of manufacturers, whose capital to the extent of many millions is involved in patents, are imperiled by inefficient work; and the increased number of patents and the general progress of the arts render the proper examination of applications each year more difficult. The erroneous issue of a single patent may easily involve the loss of ten times the amount of the yearly pay of an examiner. These examiners are not only to grant patents, but to see that none are improperly granted. Inventors pay to the government more than enough to afford the small pay now allowed. To take possession of this fund, and then furnish half paid (and consequently poor) service, seems like a fraud on inventors. Should the proposed reduction be made, it will be impossible to keep up the business of the Office." The receipts from applications for patents have run up from $703,191.77 in 1873 to $743,453.36 in 1875, and the surplus last year was $21,795.65. The appropriation for 1875 6 was $436,400; the House bill proposes to cut down the appropriation to $370,220, and the working force from 351 to 294.

Black Varnish for Iron.

A durable black and shining varnish for iron is made by adding to oil of turpentine strong sulphuric acid, drop by drop, stirring until a sirupy precipitate is formed, and no more of it is produced on further addition of a drop of acid. The liquid is now repeatedly washed with water, until the water exhibits no more acid reaction. The precipitate is next brought upon a cloth filter, and after all the water has run off, the sirupy mass is fit for use. This is painted over the iron with a brush, being previously diluted with oil of turpentine, in case it does not flow well. Immediately afterward, the paint is burnt in by a gentle heat, and, after cooling, the black surface is rubbed with a piece of woollen stuff dipped in linseed oil. This varnish is said to combine chemically with the metal, and does not wear or peel off.

SOME idea of the immense slaughter of buffaloes which yearly takes place on the plains and which is rapidly leading to the total extinction of that animal, may be gleaned from the fact that seven cars freighted with buffalo bones recently arrived in this city. The material will be worked up into buttons, knife handles, etc.

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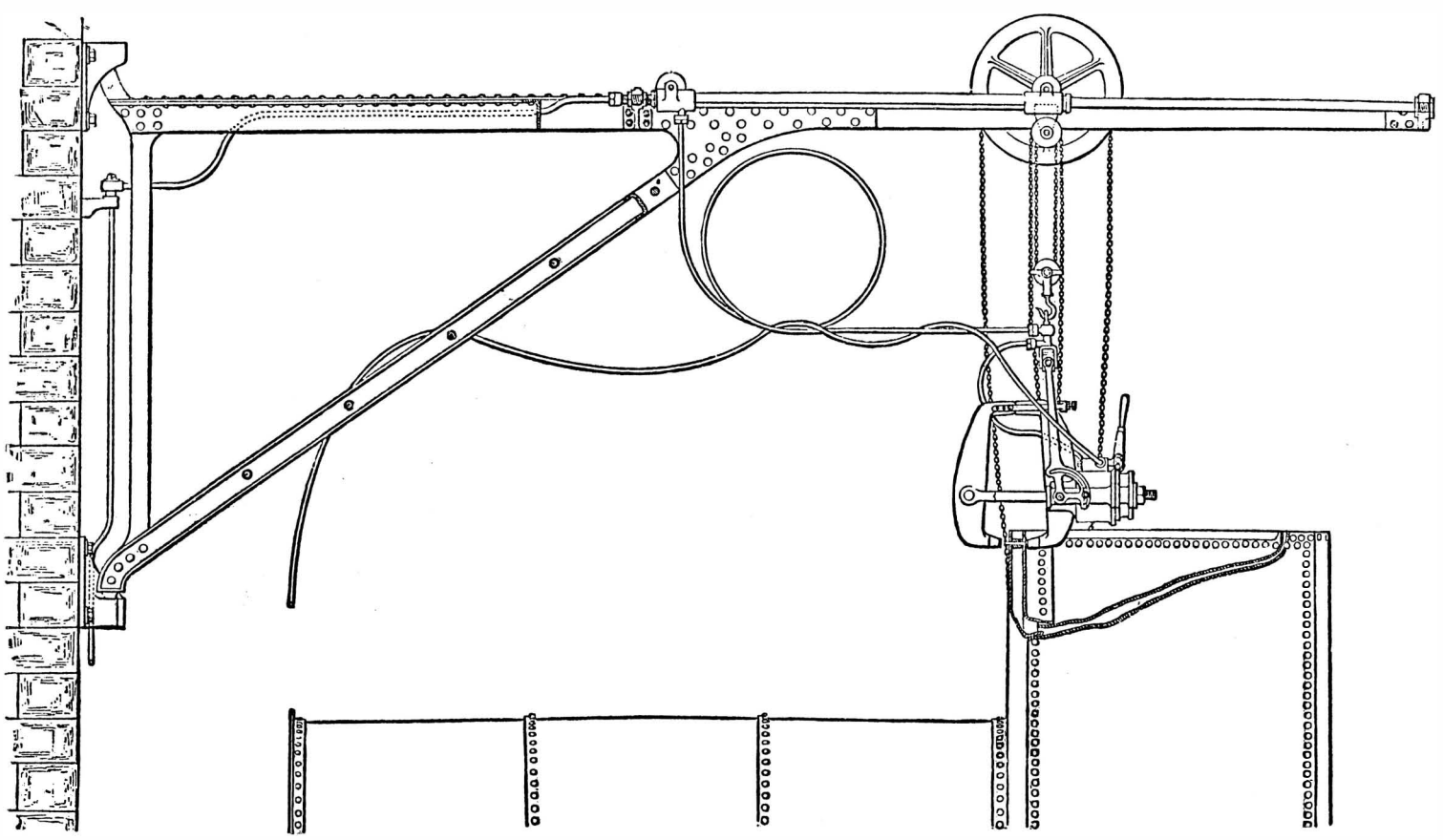
A PORTABLE HYDRAULIC RIVETING MACHINE.

Mr. Tweddell, a well known English mechanical engineer, has recently designed apparatus for riveting locomotive boilers without removing them from the engines. The machine has been erected and is now in use at the Crewe Locomotive Works of the London and Northwestern Railway, where it has been found very useful for doing such work as could not conveniently be brought to the fixed riveting machines.

The arrangement, says *Engineering*, is so simple that not much description is needed. An ordinary swing crane has attached to it an hydraulic sleeve or outer cylinder, which is moved along a fixed tube or pipe by means of a pinion worked by a sprocket wheel, this pinion gearing into a rack attached to the crane. The water, which is supplied under a pressure of 1,500 lbs. per square inch from one of Tweddell's differential accumulators, is taken from the main laid along the shop wall, and thence up the center on which the crane radiates. Thus any motion caused by swinging the crane is reduced to a minimum, and a swivel joint, almost frictionless, causes no twisting strain to be imparted to the pipe. After leaving this joint the pipe is led along the jib, as shown. There is communication between this fixed pipe and the larger one which slides on it, and this sleeve or sliding tube is balanced.

The riveter is hung from one end of the sliding sleeve, and the pipe conveying water to it from the other. The water is then, by means of a simple frictionless universal joint, led into the machine, which is free to turn completely round in a horizontal plane. The raising or lowering is done by blocks, and the angle of the machine jaws can be altered from vertical, as shown, to horizontal, by the quadrant in the suspending gear. It will be seen that there is no strain on any of the pipes, and the great difficulty in transmitting the pressure to a riveter or other machine in a portable form is overcome. We understand that the saving in cost of riveting by this method over the present mode is about four fifths, and the quality of the work is, like all that done by hydraulic pressure, excellent.



TWEDDELL'S HYDRAULIC RIVETER AND CRANE.

THE MANUFACTURE OF ANTHRACENE.

We illustrate herewith an improved method of obtaining anthracene, one of the most valuable products from coal tar, which has been invented by Messrs. Fenner and Versmann, of England, and patented in this country. The inventors claim that they have succeeded in obtaining anthracene from coal tar pitch, all previous attempts to do which have been failures. The anthracene is obtained in a comparatively pure state, with only a small proportion of other hydrocarbons, such as naphthaline or chrysene, mixed with it. Progressively increasing temperatures are employed in the distillation till finally a heat as high as 600° or 800° Fah. is reached. As the heat rises, the more solid constituents of the pitch become volatilized, till anthracene comes over; this occurs at a temperature of 600° or 800°.

Fig. 1 represents a plan view, and Fig. 2 a side view, partly in section, of the apparatus. *a* is a cast iron vessel, in which the coal tar pitch is placed for distillation by the furnace, *b*. *c c* are flue spaces by which the heat may be retained in contact with the surface of the vessel, *a*. *d* is a pipe with a stop cock, *d'*, by which pitch may be supplied to this vessel, *a*, and *e* is a pipe by which the anthracene and matters combined therewith, obtained in the distillation, are conducted in the form or vapor from the vessel, *a*, to a condensing chamber, *f*; but in the passage of the vapors along the pipe, *e*, they become cooled by the surrounding atmosphere, and the products of condensation flow by one or other of the branch pipes, e^1 e^2 e^3, to the receiving tank, *g*. The oil collected in the vessels or tanks, *f* and *g*, is drawn off therefrom through suitable taps. When the product distilled at about 400° begins to issue from *a*, it passes along *e* and at first reaches to and (part being principally non-condensed vapor or gas) enters *f*, as the temperature is raised, and anthracene begins to pass over. The richer oily product containing anthracene passes along e^1 into the chamber, *g*. The temperature being still further raised, or continued at a high standard, such as from 600° to 700°, the oily product distilled becomes more charged with anthracene. The tap in the branch pipe, e^2, is then opened, and if necessary, owing to the increasing density of the oil, the tap in the tube, e^3, is opened, so as to provide a short and ready passage for the distilled product into the receiving vessel, *g*.

Fig 1

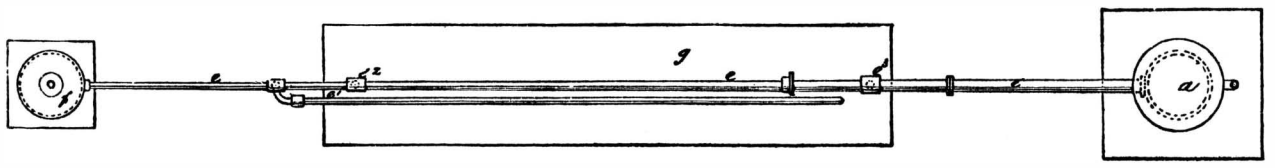
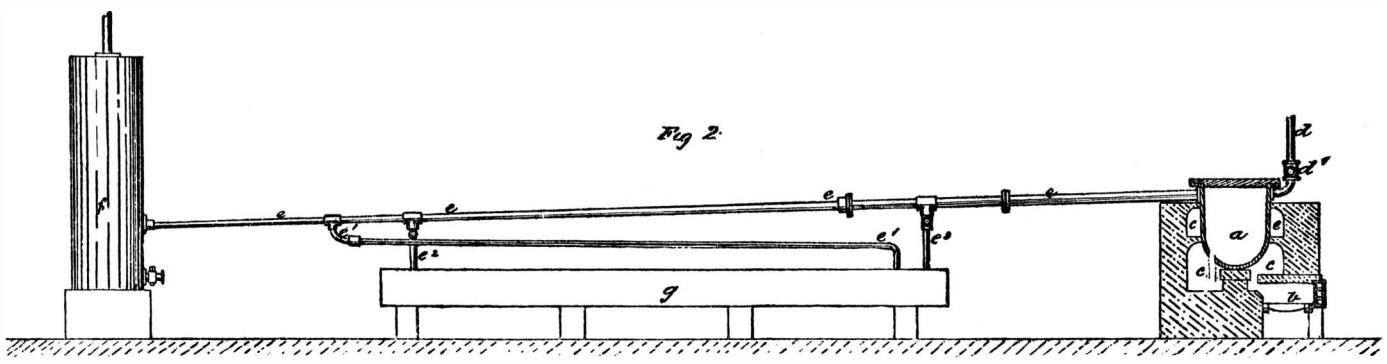
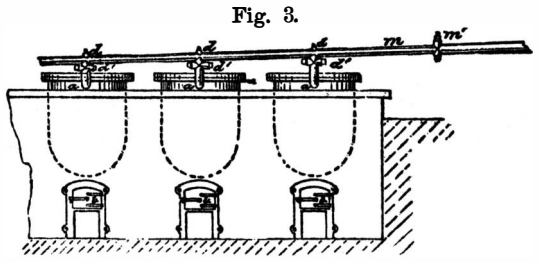


Fig 2.



FENNER AND VERSMANN'S METHOD OF MAKING ANTHRACENE.

Fig. 3.



The production of anthracene can herein be combined with the distillation of heavy oils from coal tar (thus making one continuous process of the two operations) by distilling the heavy oils from coal tar in a wrought iron boiler, *n*, connected with a set of cast iron retorts, *a*, taking care, however, that they are capable of withstanding the high heat. As soon as the heavy oils have been worked off, a residuum of pitch is left; and without allowing to cool, it is at once run off into a set of vessels, *a*, which have been previously heated, and in which the distillation is proceeded with until the liquid or gaseous products have passed over to the condenser, aided in some cases by the use of a partial vacuum. Fig 3 represents a sectional view of the apparatus arranged to operate according to this method of working. *m* is a pipe by which liquid pitch may be conducted from the boiler, which is not shown in the engraving, to branches, *d*, with taps, *d'*, by which to supply vessels, *a*, such as already referred to. *m'* is a tap in the pipe, *m*, to regulate or to stop the supply, as required.

An Ostrich Egg Incubator.

We have pointed out in previous articles that the raising of ostriches in this country, for their feathers, might prove a profitable industry. It would further seem that the simplest way of obtaining the birds would be to procure the ostrich eggs, and pack them according to the well known recipes for preserving hens' eggs. On their arrival in this country, hatching might be accomplished by an incubator similar to that now in successful use in South Africa. The apparatus is a wooden box about three feet square, open from above and capable of containing twenty-five eggs. It rests upon a copper or zinc pan three inches deep and equal in size to the box. The warm temperature of the water is maintained by a paraffin lamp kept burning outside, underneath an extension of the pan which is carried through the wall of the box. The heat can be regulated as necessary, thermometers being constantly in use. The temperature of the box where the eggs are placed is 102° Fah. when they are first put in. After two weeks it is gradually reduced to 100°, and in two weeks more to 98°. The period of incubation is forty-two days. The eggs are turned and aired by opening the box and blanket covering once or twice a day. A fortnight before the time they are held up against the light to examine their condition, and a week after are slightly punctured near the top, to enable the chicks more readily to break the shell. When hatched they are turned, kept warm, and fed with cut lucerne, and allowed to run about their inclosures like ordinary fowls. It is stated that in natural hatching the average number of birds raised is sixteen out of twenty eggs; in artificial, when properly managed, not more than one out of twelve eggs fails.

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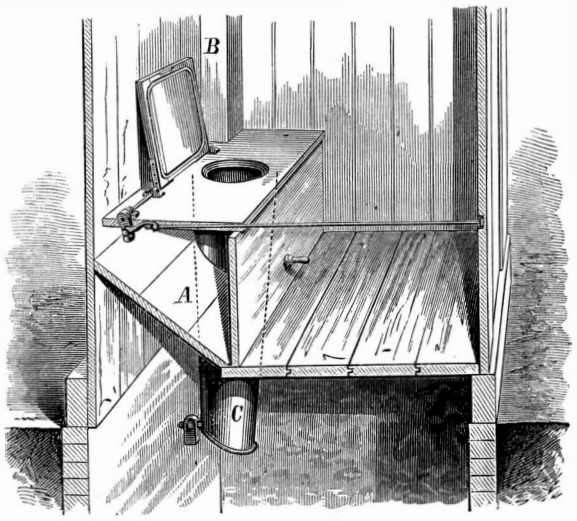
THE CATTLE OF THELEMARK, NORWAY.

We find in an interesting report by Mr. H. M. Jenkins, on the agriculture of Sweden and Norway, a description of a remarkable breed of cattle indigenous to Norway, which, even in these days of cross breeding and improvement, is still found in its original purity. We select the engraving from the *Journal of the Royal Agricultural Society of England*, Mr. Jenkins being commissioned by the Society to make the report. The cattle, as will be seen, are small, full grown cows seldom attaining a greater weight than 700 or 800 lbs.; they are a mountain race, and their diminutive size may be fairly attributed to the poverty of their food and the rough weather and long winters of their habitat. They are good milkers, the best in this particular of many breeds kept at the royal farm at Ladegaardsoen having been of this race. Moreover, the care and good living bestowed on the race at the farm have somewhat increased the stature and weight of the animals. One cow milked, in 1868, 646¾ gallons, in 1869, 720 gallons, in 1870, 689¼ gallons, or on an average of three years, 685½ gallons, with a living weight of about 790 lbs.; that is nearly 9 lbs. of milk for each 1 lb. living weight annually, a result which bears comparison with the best milking breeds. Usually the Thelemark cows do not milk highly immediately after calving, seldom more than 3⅓ gallons daily, but they maintain the yield evenly, and do not remain long dry. Like every other good milking breed, the Thelemark cows are very liable to milk fever; for which reason it is very important to keep them on a low diet for some time before and after calving.

THELEMARK CATTLE.

SELF-CLOSING CLOSET LID AND ANTI-NUISANCE CLOSET.

The invention represented herewith aims to exclude sewer or vault gases from yard closets, and to offer protection against the very injurious cold draft in these as well as in railroad car accommodations. The lid is provided with a self-closing device and elastic packing, which exclude the gases from all sorts of closets. The closet door is suitably connected with the lid, so that, when the former is opened for the exit of the user, the lid is shut invariably. A board apron, A, below the seat closes the vault, compelling the gases to pass out by the ventilator flue, B. A tube, C, attached to the lower side of the seat board and provided below by a



balanced valve or flap, passes through the apron, tightly fitted by packing. Anybody cognizant of the present unwholesome yard closets and railroad car accommodation, throughout the country, will readily appreciate the improvement.

Patented December 14, 1875. For further information, relative to sale of rights, etc., address R. d'Heureuse, P. O. box 395, New York city.

Packing Butter.

A well known dairy authority gives the following directions for packing butter so that it will keep sweet for 8 or 9 months: "Make a brine with a saturated solution of the purest salt you can get, using 1 lb. of saltpeter to about 20 lbs. of salt. Scald the brine by bringing it to a boiling heat, skim, and apply when sufficiently cool. The casks should be carefully prepared as well as the brine. If the gum and sap in the wood are not removed before the casks are used, they will work out into the brine and affect the butter. To remove the woody flavor from the casks, a thorough steaming with a high pressure is the quickest and best means. If soaked before the steam is applied, hot steam will cut the gum and woody flavor all out in a short time. If steam is not convenient, soak in brine a week or so, and then fill with boiling hot brine, and let it stand till it gets cool. By keeping the butter under the brine and the casks full and in a cool place, the butter can be kept safely. Some of the tin-lined packages which have recently been introduced, and which are easily hermetically sealed, would be much more convenient and probably fully as cheap as the oak casks and brine, and are claimed to be equally efficient in preserving."

Straightening and Bending Pipes.

In order to straighten lead pipe, if the bore of the pipe is 1 inch or more in diameter, dress out a wooden rod small enough to enter a hole the size of the bore; then point one end, grease the surface thoroughly, and work and drive the rod into the pipe. Draw the rod back and turn it a trifle at every blow. If the pipe is small, less than one inch in diameter, drive in a pointed iron rod, turning it at every blow, so that the rod may not stick so tightly that it cannot be withdrawn. To bend a lead pipe without forming kinks, fill the bore with dry sand. To bend an iron pipe, fill the bore with dry sand, stop the ends with stiff clay, heat the pipe where it is desirable to have the curve, and the pipe will bend readily without making kinks. If the dry sand will not run out, water will wash it out.

Annual Report of the Chief Signal Officer.

We are indebted to Brigadier-General Albert J. Myer, Chief Signal Officer, U. S. A., for a copy of his annual report, being for the year 1875. This book, of 475 pages, exhibits annual reports from the United States Signal Stations in every part of the United States, in the West Indies, Canada, and Alaska, showing the work done, the number of disasters averted, the improvements made, and the wide favor in which the signal service is held. It contains monthly weather reports for the year for all parts of the country, illustrating by numerous charts, the temperatures, barometric pressures, rainfall, humidity, and direction and force of winds. It is a record of all important electrical and optical phenomena, all general storms, and all marine disasters. It contains several large international weather maps, which illustrate the great meteorological changes in North America and Europe. The oscillations or variations of the tides, of the principal rivers in the United States, are recorded by diagrams. The records of miscellaneous phenomena are interesting and extensive, covering natural history, forests, polar lands, meteors, zodaical light, earthquakes, etc. The extensive, varied, and exact information contained in this report makes it a document of unusual scientific value. It is published at the government printing office, Washington, D. C.

Toning of Photo Transparencies on Glass.

This operation is scarcely necessary if the transparency should have been reinforced with acid silver, and is only required to be viewed by transmitted light. But silver as well as alkali-intensified films have generally a very disagreeable color by reflected light, and many amateurs object to this. The use of a weak solution of chloride of gold obviates this difficulty, but, unfortunately, the color thus given is too cold to suit many tastes. The best toning agent we have used is chloride of copper, followed by an application of alkaline pyro.; any tone by transmitted light is attainable, while the color of the deposit by reflected light is either black or a deep warm brown. On no account resort to any of the formerly recommended methods of toning by mercury; the colors, though beautiful to the eye, are evanescent, and sooner or later the picture becomes one shapeless blotch.—*British Journal of Photography.*

Fast Ocean Steaming.

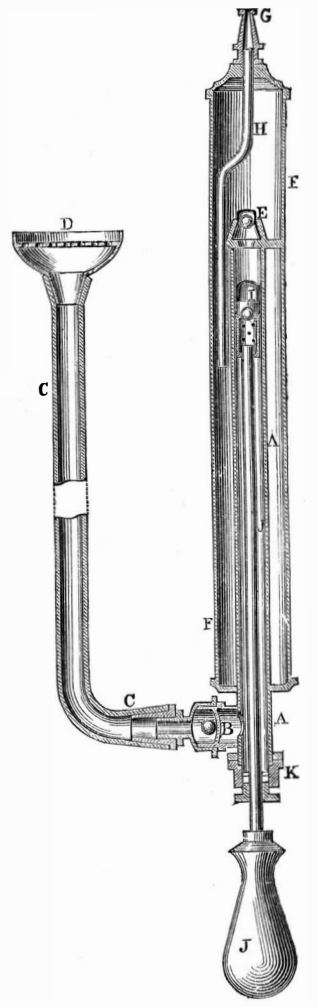
The Germanic, mean displacement 8.525 tuns, recently made the trip from New York to Queenstown, Ireland, 2,894 national miles or knots, in 7 days, 15 hours, 17 minutes, being an average of 15·8 knots per hour. This is the fastest time on record. The mean boiler pressure throughout the voyage was 63 lbs., mean vacuum pressure (condensers) 27 inches, revolutions of engine 55·57 per minute, indicated horse power, 5,434.

The Coming Fiber.

It is well known that with proper methods a certain percentage of fiber suitable for felting into a sheet which may be called paper can be produced from any plant that grows. This fact shuts the door in the face of the inventor in this line. It is possible to obtain letters patent in this country for a certain plant as a material for papermaking, but the value of such a patent is questionable. All who are interested in seeking new papermaking materials among the products of the vegetable kingdom must bear in mind the several absolutely essential elements which are necessary to any successful operation. A vegetable fiber, to compete rags or other leading material, must be such as will admit of yearly production either from its own root or from seed sown and cultivated, like jute or straw; it must grow in large quantities, and must not present great obstacles to ready and cheap harvesting; it must be grown in easy connection with cheap transportation lines; it should yield at least fifty per cent good fiber; and should not offer difficulties which the present improved systems of treating other vegetable fibers will not readily overcome. Failing to possess any or all of these attributes, any new candidate to the favor of the trade would undoubtedly meet with disfavor. As stated above, the vast majority of the so-called new fibers fail in one or more of these essential points, and people who are experimenting to-day with such materials will only have their labor for their pains. It may be truly said that this diligent search for new vegetable fibers is to-day unnecessary. Esparto, straw, and wood are the great substitutes for rags in foreign mills. In this country wood and straw have the field to themselves. With the present processes wood can only be made into the better grades of paper by chemical auxiliaries, which are expensive and can be worked profitably only by recovering the alkalies. Ground wood is the great cheapening element in paper manufacture at present, and it can only be used in the lower grades of paper. Straw therefore comes to the point as fulfilling more completely than any fiber the wants of the trade. If worked to better advantage, it alone, in addition to rags, would furnish all the papermaking material required.—*Paper Trade Journal.*

A NEW GARDEN PUMP.

M. Reynier, of Paris, France, is the inventor of a new garden pump, easily operated, and which gives a continuous, spray-like stream which may be accurately directed to the plants which it is desired to water, without necessitating the wetting of others. Water is drawn in at the flared orifice, D (which is provided with a sieve to prevent entrance of impurities), and passes through the tube, C, and ball valve, B, to the interior pipe, in which works the perforated and valved piston, I. When this piston is drawn back, the water, already in its rear, passes through it, the valve, I, opening. On being driven forward, the valve, I, shutting, and the valve, E, opening, the water is forced into the pump body, A, where it compresses the air, which, in turn, forces it out through the tube, H, and nozzle, G. At the same time, a fresh supply of water is drawn in through valve, B. The annexed engraving is extracted from the French *Bulletin du Société de l'Encouragement de l'Industrie.*



THE mucilage used by the government for postage stamps is composed of dextrin 2 ozs., acetic acid 1 oz., water 5 ozs., alcohol 1 oz.

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Correspondence.

Multiplication of Minus Quantities.

To the Editor of the Scientific American:

As some of your readers are puzzling over the question why *minus* multiplied by *minus* gives *plus*, and *plus* multiplied by *minus* gives *minus*, I wish to explain thus:

In multiplication, it is all the same which of the factors you call the multiplicand and which the multiplicator: $2\times3=3\times2$ and also $3\times-2=-2\times3$. Now multiplication means to take one factor as many times as there are units in the other factor: -2×3 is therefore *minus* 2 taken 3 times, thus: —2
—2
—2
—6, and by the above 3 multiplied by *minus* 2 must be the same. This shows how *plus* multiplied by *minus* gives *minus*.

Again: -2×3 being $=-6$, -2×2 being $=-4$, -2×1 being $=-2$, -2×0 being $=0$, we see that the product increases by $+2$ for every unit of decrease in the multiplicator. If we then decrease the multiplicator still farther by single units, the product must continue to increase by *plus* twos, namely: $-2\times-1=+2$, $-2\times-2=+4$, $-2\times-3=+6$. Nothing seems simpler or clearer.

But if there is any one who yet fails to see how the product of multiplication can increase in proportion to the decrease of the multiplicator, let him look at it in this way: It is a negative quantity (—2) which we multiply. The negative product decreases with the multiplicator.

Three times *minus* 2 = *minus* 6, twice *minus* 2 = *minus* 4, once *minus* 2 = *minus* 2, no times (0) *minus* 2 = nothing (0).

We have here the products of —2 multiplied by $+3$; $+2$; $+1$; 0; each multiplicator being one less than the preceding one; each product is —2 less than the preceding one. Minus one (—1) is one less than nothing (0). The product of -2×-1 must therefore be one *minus* two less than nothing (0), that is, $+2$. But how does —2, taken away from nothing, leave $+2$?

To make this clear you have only to substitute $+2-2$ for 0. Of course if I have two less two, I have nothing. But ir from this nothing thus expressed, $+2-2$, you take away the —2, does it not leave you $+2$? C. F. ERHARD.

The Alluvial Lands of the Mississippi.

To the Editor of the Scientific American:

The reclamation of the alluvial lands of the Mississippi river can be accomplished simply by allowing sufficient breadth between the levees or banks on each side of the river for the water to escape through at flood hight. This can be done by straightening the levees, running from bend to bend, and allowing a breadth of from four to six miles from levee to levee, which will allow a flow of water across the neck of points in the case of extreme high water, which gives a more direct and regular current than is attainable with the present levee system, from the fact that the current across the neck meets and counteracts the force of the channel current, and prevents its rolling with so much force into the bends and against the portion of the levee that is most exposed. Besides, it would facilitate the escape of water through the Valley to the Gulf. Straightening the false banks and widening the distance between them will allow of closing the side channels without danger to the levees, and will lower the flood water mark one or two feet.

The levees, once established on this basis, will seldom need repairs. But the present system of leveling in the points confines the water at flood hight within the limits of its banks; and as the water rolls away from the point, it throws the current into the succeeding bend with its undivided weight, until the levee is forced in, and crevasse and overflow ensue. HORATIO F. HICKS.

St. Paul, Minn.

The Centennial on Sunday.

To the Editor of the Scientific American:

Correspondents of some of your cotemporaries are advocating keeping open the Centennial Exhibition on Sundays, for the benefit of working men who may be poor or too occupied to lose a working day to go and see the show. Americans generally attend some church or pass the day with their families, believing six days' labor in the week to be sufficient. Now why should several hundreds be compelled to work all day on Sunday at the exhibition buildings, in attending upon the visitors, running the railroads, etc., for the accommodation of a throng of sight-seers? It seems to me it would be better for the limited class of persons that are unable to visit the exhibition on a week day to subscribe for the SCIENTIFIC AMERICAN, and read the accounts of what is exhibited, and study the illustrations accompanying the descriptions, rather than impose needless labor upon those who prefer and need one day of rest from the arduous labors of the week.

A MEMBER OF THE SOCIETY OF MECHANICS AND TRADESMEN.

The Demand for Labor.

To the Editor of the Scientific American:

Your correspondent in Harlem, in speaking of the troubles of a tool maker, seems to overlook the fact that at the present time the supply of labor is in excess of the demand, which, of course, puts the workman or the seller of labor in the power of the purchaser or employer of labor. The remedy which he suggests, that each man should have a certificate of his skill, is rightenough for some purposes; but what is the use of a certificate when there is no situation? If two men with certificates of equal merit apply for work from the same employer, who requires but one, and stern necessity compels one man to accept any terms, he that will work for the lowest wages will of course get the preference. These men should say to each other: "There is not work for us both, but, by each working half time until there is more demand for men, we shall each not only have a fair share of what wages there are earned, but prevent the employer from pitting one against the other in the struggle to live." This remedy, I believe, should be applied at all times when the supply of labor is in excess of the demand. Of course, to those at present fully employed, it would create a slight stringency in the money market; but it would drive absolute want from many a fireside.

Toronto, Canada. ONE OF THE EMPLOYED.

How Strikes may be Prevented--Free Trade the Remedy.

To the Editor of the Scientific American:

In the edition of your paper for March 18, a correspondent complains of the fact that certain parties, after advertising for tool makers, were unwilling to pay more than $2.50 *per diem* for competent men. He thinks that the state of affairs which enables an employer to hire a skilled man for that sum is not right, and he proposes to rectify matters by having the trade "legally recognized, so as to have a complete and perfect registry kept of all men who pretend to be skilled workmen," the wages being regulated by a mixed board of employers and employees. The first thought that occurs to me on reading such letters is to wonder that a man of sufficient ability to write a letter at all, or make tools requiring intelligence in their construction, should have so little acquaintance with the laws which control wages and kindred matters, as is exhibited by D. In expressing his disbelief in the efficacy of strikes to smooth the way of the working man, D. shows that his is not as hopeless a case as others; but he has a longing for governmental interference between employer and employed that savors too much of communism to be acceptable to working men of self-dependent power. He condemns strikes, but attributes the prevalence of those organized acts of folly to the fact that employers get men to work for the lowest wages they will take. Why will not D. and men who argue in his train of thought consult their own action, and learn the true explanation of the labor troubles? Does D. ever pay $10 for a pair of boots when he can get as good ones for $5? If he does not, how can he expect an employer to act on different principles, and pay $4 a day to workmen when other men of equal skill ask to be employed at $2.50? "But," says D., "they are not of equal skill, and the employer does not get as profitable return from the $2.50 as he would from the $4 00 one." Will not D. see that the employer, in the majority of cases, knows his own business best, and that it is better that he and the workman should make terms on which to exchange money and labor rather than call in the assistance of outside parties to settle it for them? Would D. maintain that it would be better to make him give A $ 10 for the boots than get them of B. for $5, or exchange four days' labor for what can be had for two days'?

Men will be better off when they learn to look facts in the face, and not delude themselves with sentimental longings for a Utopian state where "everything is lovely." This wages and labor question is simply a continuation of the fight for existence which Science shows to have gone on in the past among all living things, and still goes on.

The present writer is a working man, and as anxious as anybody to get the best price for his labor; but he has had the good fortune to have read works by the working man's best friends, the writers on political economy, and he has become convinced that the truth, as established by Nature and confirmed by experience, is what should guide working men in their efforts to improve their general condition. It is unfortunate in the extreme that elementary works on political economy are not studied in the public schools. From the halls of Congress to the humblest workshop in the land, profound ignorance reigns on subjects of vital importance to the public welfare. When grave and reverend senators eloquently advocate excluding the products of foreign countries, so as to reduce competition with the interests they represent, there can be no consistency in the bosses of those factories condemning the principle of strikes. But both are wrong. The striker is wrong, not in refusing to work if he does not like the wages, but in obliging others to desist from working for the wages he refused. The protectionist is worse than the striker; for while looking solely to his own interest, he pretends to have the welfare of his working men at heart, and besides uses the public money and officials to secure himself against competition, that is, he can sell dear where but for them he would be obliged to sell cheap. The labor problem is so complicated that no one can, in newspaper articles, explain and make clear every point of the subject; but a vast deal of good can be accomplished by directing the attention, of those most interested, to sources where the subject is discussed in full. If every working man, and every employer too, in the country would read Bastiat's little book on political economy, I think that it would do much to put an end to strikes and disagreements among employed and employers. It would show both parties how dependent on each other they are, and teach them the folly of quarreling. It would also open the eyes of working men to the mistake they make on the whole, when they sustain the doctrine of protection and monopoly. Capital is simply preserved labor, pickled down for future use. The workman's capital is his skill and strength; he ought to be allowed to exchange it at will, and where he can do it to the best advantage; but the striker and protectionist deprive him of that right. When justice comes to rule the world, protectionist and striker will have no advocates. In that day it will be admitted that perfect freedom is the condition most conducive to general and individual prosperity, and that, although competition and the introduction of machinery may occasion temporary suffering, the cause of virtue, happiness, and progress is best promoted by free trade.

Rochester, N. Y. E. R.

The Great Engineer for President.

To the Editor of the Scientific American:

Your nomination of James B. Eads for President was a happy thought, whether it will amount to any thing or not. There are many, who now never go to elections, who would go if there were any hope of electing a man of his intellect, who could not be corrupted. "But," says one, "what evidence have the people at large of his great intellect, or of his incorruptibility?"

By his works we know him to be a man of great intellect; and by his dealings with men, as well as with Science, we know that he is not liable to be led astray. The choice of his education in the exact sciences shows that he was born a lover of truth; and his success in mastering and applying them indicates an intellect which will not easily turned into uncertain ways.

What could produce a happier Centennial event than to elect such a man President, one who has never been soiled by politics, whose great intellect has always been on the track of truth, with such universal success?

Lyons Falls, N. Y. D. S. HOWARD.

[For the Scientific American.]

ARTIFICIAL ICE.

BY P. H. VANDER WEYDE.

It has been explained in the previous article, published on page 177, current volume, that when, without the aid of heat, water is evaporated by means of a vacuum, aided by the absorbent action of sulphuric acid on watery vapor, the latent heat needed for the formation of this vapor will cause the abstraction of so much heat as to freeze five eighths of the remaining water. In a liquid more volatile than water, this evaporation takes place more readily; and hence many attempts have been made to produce cold by the evaporation of very volatile substances, such as alcohol, various ethers, carbon bisulphide, liquid ammonia, and even nitrous oxide and carbonic acid. Among the partially successful attempts, I may mention those made some 15 years ago by Professor Twining, of New Haven, and Siebe, in England; they used common ethylic or so-called sulphuric ether. More recently, about 10 years ago, Tellier, in France, used methylic ether, of which the effectiveness was supposed to surpass that of the ethylic ether in proportion to the lowness of its boiling point, which is at about 0° Fah., while the common ether boils at 90° Fah. It was, however, soon found out that there is no advantage in using liquids of such very low boiling points, as part of the power used has to be employed for working powerful compression pumps to reduce the obtained vapors to the liquid condition, as of course economy of the process absolutely requires the use of the same liquid over and over again. The use of two other liquids was patented some eight years ago: one, carbon bisulphide, by Professor Paersh, of New Orleans, and chymogene (petroleum ether), by myself. The first of these liquids boils at 112° Fah., while the latter has the advantage of being cheap and abundant, being a by-product of petroleum distillation, where it can be obtained in various degrees of volatility, varying in its boiling points from 20° to 50° or more Fah. It ought to be stated that the vapor of the substance is quite dense, being 4 times heavier than atmospheric air, while in its fluid condition it is decidedly the lightest of all liquids, its specific gravity being 0 6. So that while water, when evaporating, expands to 1,728 times its volume, forming a vapor of which the specific gravity is about half that of the atmosphere, the expansion of the liquid, when assuming the state of vapor, is only equal to $1,728\div2\times4=216$ times. As the amount of expansion which various liquids undergo, when evaporating, bears a close relation to the amount of latent heat absorbed by the vapors, this small expansion may appear disadvantageous to the use of light liquids producing heavy vapors, for the purposes of refrigeration; however this ise especially in the case of chymogene, compensated for by the fact that, in displacing vapors by the air pump, we have only to do with volumes; and as the figures representing tht latent heat of vapors have only relation to equal weights, ir is evident that a heavier gas will, for the same bulk, contain an amount of latent heat proportional to its specific gravity, and will therefore withdraw, during its formation, a proportionately large amount of heat from the material to be cooled. As an offset to this, the latent heat of gases is almost in inverse proportion to their specific gravity; so that after all, the amounts of latent heat for equal bulks do not diffe, widely, but vary only slightly from just under 400 to a little over 600 Fahrenheit units of heat.

Chymogene possesses one special advantage in its boiling point, which is not so high as to require so great a degree of exhaustion to evolve the vapors as is the case with water, and even alcohol, carbon bisulphide, and ether, nor so low as to require extraordinary pressure to recondense the vapors to the liquid condition, as is the case with ammonia, methylic ether, and especially nitrous acid and carbonic acid.

In regard to the two last named substances, they were thoroughly tried, in their liquefied condition, as to their adaptability to produce cold and refrigeration. The first, nitrous acid, boiling at 130° below 0° Fah., was tried by me; and in 1864 I applied for a patent for the invention, but soon

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withdrew and abandoned the same, becoming convinced of the serious disadvantage of having to employ machinery calculated to withstand pressures of 700 or more lbs. to the square inch, which this liquefied gas exerts at the common temperature of 65° Fah. Professor Lowe, of balloon fame, in attempting to use the pressure of carbonic acid gas (when liquefied by powerful pumping machinery, under a pressure of 600 lbs. to the square inch) as a source of power for flying machines, was struck by the evolution of great cold during the evaporation of this liquefied gas; and he obtained patents for its use for making ice, and for refrigeration in general. Notwithstanding that he spent many thousands of dollars to put this scheme in practical operation, and kept to its pursuit for several years, it finally utterly failed; and all attempts in this line were given up, the stumbling block being the same as was found in using liquefied nitrous acid, namely, the difficulty of keeping the joints tight under the enormous pressure required; for even the solid metals themselves showed, under the extreme pressure, such porosity that the gases passed through as through a sieve.

The process of Professor Paersh, of New Orleans, using carbon bisulphide, was abandoned for a contrary reason. Its boiling point being 112° Fah., more than 22° above that of ether, it was even less successful than the common ether, the process for which has never been quite satisfactory, as fully proved by the results of the labors of Siebe, in England, Twining, in New Haven, and others afterward.

Liquefied sulphurous acid boils at 14° Fah., and at the increased temperature exerts a pressure of 60 lbs. per square inch, or 4 atmospheres; and thus it appears well adapted for the purpose, and some years ago it was proposed to use it, and, if I am not mistaken, its employment was patented by Professor Seely, of New York city; but its corrosive effect on the metals of which the machine was made forbade its practical application.

The methylic ether machine of Tellier, in France, was at first said to be a great success; and about 10 years ago one of the apparatus was imported from France and exhibited in operation at the Morgan Iron Works in this city. There appears, however, to have been great difficulty in procuring the pure methylic ether required, notwithstanding that its preparation had been minutely described in Tellier's patent. The ignorant persons who had charge of the machine became possessed of the idea of cutting short all trouble, by using ammonia, which was easily procured; and, as any well informed person could have warned them, within 24 hours the whole beautiful machine, a credit to the Parisian workshops whence it came, was utterly ruined, the ammonia having destroyed all the brass parts. Machines using ammonia are therefore always built entirely of iron.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XLV.

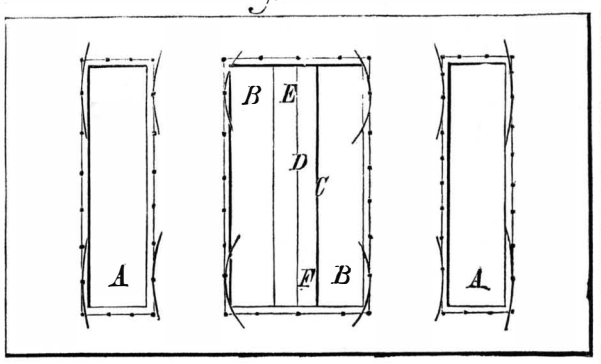
MARKING OFF SLIDE VALVES AND CYLINDER PORTS.

If, in marking off a set of cylinder ports and a slide valve for the same, we are provided with a detail drawing, we have no option, of course, as to their proportions; but if, on the other hand, we have liberty to proportion the same, we have to consider the following: If we make the slide valve to cover the ports without having any steam lap, the exhaust will not be sufficiently free, and there will be a back pressure upon the engine. The amount of steam lap necessary to prevent back pressure will be an amount equal to one quarter of the width of the steam port in a slowly running engine, and equal to about three quarters of the width of the steam port in a fast running engine. If it is incumbent that the valve have no steam lap, or an amount of such lap equal to or less than one quarter of the width of the steam port, we may make the cylinder exhaust port about one and three quarters as wide as the steam port, which will be sufficient to maintain, at all parts of the stroke, an exhaust opening in the cylinder exhaust port equal to that obtaining in the steam port acting (at the same point of the stroke) as an exhaust port: the object of narrowing the cylinder exhaust port in this case being to keep the valve narrow, so that its friction upon its seat may be kept as small as possible, in consequence of its reduced area for the steam to act on, pressing it to its seat. The best results are obtained from a slide valve by giving it sufficient steam lap to cut off the steam supply when the piston has traveled about three quarters of the length of the stroke; if more than such an amount of steam lap be given to the valve, its action becomes distorted, that is, unequal at and during one stroke as compared to the ther

The area of the steam ports should be proportioned by the following rule, which is given by Mr. John Bourne in his "Catechism of the Steam Engine:" "Multiply the area of the cylinder in square inches by the speed of the piston in feet per minute, and divide the product by 4,000. The quotient will be the area of each cylinder port in square inches." This rule is a much better one than any which gives a definite and fixed proportion between the area of the cylinder and of the steam port, because it takes into consideration the quantity of steam required to pass through the port in a given time, and increases the area of the port in proportion as the speed of the engine is increased.

Having determined the dimensions and proportions of our ports and valve, we proceed as follows: Beginning with the cylinder, we place in the exhaust port a center piece, as shown in Fig. 231, in which A represents the steam port, B B the cylinder exhaust port, and C the center piece wedged or fastened therein. In the center of the position intended for the ports, we mark upon the center piece the center line, D, and from the points, E, F, we mark with the compasses the segments of circles from which the width of the steam ports, exhaust port, and bridges are marked, the lines being drawn by the aid of a straight edge. We mark the ends of the ports by the aid of a straight edge and square. To mark off the valve, we may either plane up two of the edges and

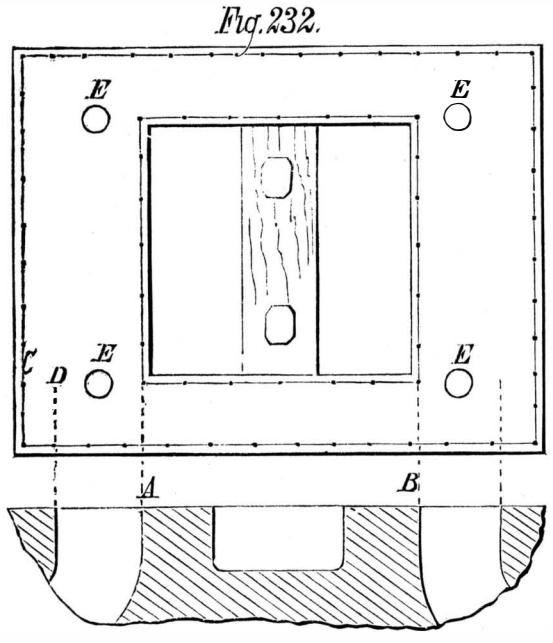
Fig. 231.



mark the lines by the aid of a square, allowing an equal amount to be taken off each side of the exhaust port, or we may place a centerpiece in the exhaust port of the valve, and perform all the marking-off before any of the planing is done, the operation being shown in Fig. 232. From A to B is the width of the exhaust port of the valve, and from C to D on each side is the lap of the valve.

It is found that valve seats (the cylinder faces on which the valves slide) will have when they become worn, a groove cut across the bridges between the ports and extending along the face beyond on each side, running close to the edge of

Fig. 232.



the ports, and at right angles to the lengths of the ports. To prevent the formation of this groove, it is found necessary to drill in the face of the valve the four small holes (say of ¼ inch diameter) shown in Fig. 232, at E, E, E, E, their depth being about half the thickness of the valve.

To mark off the back of the valve where the slide spindle frame fits, we must stand it on the marking table, with the face standing perpendicularly and at a right angle to the face of the table, and draw a center line on the back of the valve, from which line we may mark off the back of the valve to the necessary conformation.

PROGRESS OF THE CENTENNIAL EXHIBITION.

The exhibition buildings and grounds are fast approaching completion.

THE MAIN BUILDING

is completed internally, the painting and gas pipe connections having just been finished. Show cases are rapidly appearing, that of Devlin, the clothier, being especially notable, both for its style and size. The floor is strewn with packages, prominent among which, on account of their size, are those sent by J. D. Burchall and Co., woolen manufacturers, of Leeds, England, containing woolen goods, and cases of terra cotta from Messrs. Doulton, of England, who are erecting four elegant show cases in which to exhibit pottery and porcelain. Among the exhibits forwarded by the Secretary of State for India, London, England, is a fine muslin, into which threads of gold are interwoven. This material is made exclusively for the rajahs in India, and is so fine in its texture that 50 yards of it can be doubled up and passed through a lady's finger ring.

INDIAN COURT.

The exhibits for the Indian court are nearly all in the building, having been transported from the Indian Museum, London, England.

The Egyptian, Norwegian, Chilian, Spanish, and other courts are all graceful and nationally characteristic edifices, and are fast approaching completion. They promise to be among the most attractive parts of the exhibition. The Norwegian goods are mostly on the ground.

MACHINERY HALL.

In the Machinery Hall, the workmen are busy erecting the shafting and laying steam pipes for the Corliss engine, all the parts of which are on the spot, and most of them erected.

Messrs. Mirrelees, Tait, & Watson, of Glasgow, Scotland, are erecting an engine and sugar mill, the total weight of which is 180 English tuns. It is a compound beam engine, of the parallel motion order, with Corliss valves, the high pressure cylinder being of 24 inches bore and 56 inches stroke. The top roller of the mill weighs 24,780 lbs. The entries of the above firm also include 26 and 36 inch centrifugals and two smaller engines, one driving a small mill and one driving a centrifugal. One of these engines is a valveless engine, which takes steam through the head of the piston, which is a very long one, having in it ports arranged to operate with ports in the bore of the cylinder, and not at the ends thereof.

Messrs. Wm. Sellers & Co., of Philadelphia, have their slotting, planing, vertical, and horizontal boring, drilling, and punching and shearing machines, as well as several large and small engine lathes, in position. J. Mitchell, of Philadelphia, is erecting a column composed of English, French, German, American, and Austrian grindstones, of various grades. J. P. Morris, of Port Richmond Iron Works is erecting a vertical column compound engine of the following description: High pressure cylinder, 50 inches in diameter, of 84 inches stroke; the low pressure cylinder is in line with it, so that both piston heads are fast upon one rod. The valves are constructed under Wanock's patent, and are balanced. The (two) fly wheels are each 24 feet in diameter, and of 21 tons weight, the whole engine weighing 110 tuns. This engine will drive a blower (for blast furnaces) of the following description: The cylinder is like an ordinary steam cylinder, and is provided with a similar piston, save that the piston rings are composed of maple wood, and are cut in segments to accommodate their being set out. The blower valves are of the griddle order. The size of the blower cylinder is 90 inches in diameter by 7 feet in stroke.

The floor spaces are all marked off, and many foundations for the various entries are being laid. Some few of the exhibitors who have their entries all ready are delaying the placing of them in position in the hopes of being able to obtain space in more prominent locations, provided the owners of such latter space shall be dilatory enough to warrant the commissioners in disposing of the space now allowed to them. The fears of the latter are, however, having the effect of hastening the forwarding of entries; hence it is improbable that any reallotment of space will take place, save in the case of those who are very much behindhand.

THE GROUNDS.

Swarms of workmen are busy leveling roadways, removing *débris*, and laying out the grounds and planting additional shrubs, evergreens, etc., notwithstanding the unpropitious weather. The railroad men, both steam and horse car, are at work in full force, giving promise that their preparations will be completed in ample time.

AGRICULTURAL HALL.

The above hall is the most backward of all the buildings but the rate of progress is proportionally rapid, every day making a noticeable difference in its appearance. The working force is here exceptionally strong; and there is evidence that it will soon be ready for the reception of entries

THE FOREIGN EXHIBITORS.

As a rule, the foreign exhibitors have more goods upon the ground than is the case with the American entries, a fact to which their representatives point with a feeling of pride. There is no doubt, however, that the arrival of American goods will, during the coming week, be very large. Representatives of foreign governments who were present at the Paris and Vienna Expositions give it as their opinion that the vista of the main building at Philadelphia excels, in general design, lightness, and airiness, that of any previous international exhibition.

A Metric Treaty.

The President has recently sent to the Senate for ratification a treaty, the object of which is to establish an international uniformity and precision in the standard of weights and measures. The treaty is between the United States and the governments of Austria, Argentine Republic, Belgium, Brazil, Denmark, Spain, France, Italy, Peru, Portugal, Russia, Sweden and Norway, Switzerland, Turkey, and Venezuela. It contains an agreement between all the parties to maintain in Paris, at the common expense, a permanent bureau of weights and measures, to be under the control of an international committee. The bureau is to be charged with the following duties:

1. All comparisons and verifications of the new prototype of the meter and kilogramme. 2. The custody of the international prototypes. 3. The periodical comparison of the international standard with the international prototypes and of test copies, as well as comparison of the standard thermometers. 4. The comparison of the prototypes with the fundamental standards of non-metrical weights and measures used in different countries for scientific purposes. 5. The standarding and comparison of geodesic measuring bars. 6. The comparison of standards and scales of precision, the verification of which may be requested by governments, scientific societies, or even by constructors or men of science.

WE are indebted to Mr. R. O. Morris, Secretary of the Rod and Gun Club, Springfield, Mass., for a very attractive pamphlet containing a list of premiums and rules to govern the dog show which takes place on April 26, under the auspices of the abovenamed club. Many very handsome premiums are offered, and it is expected that the exhibition of pointers and setters from all parts of the country will be especially large and fine.

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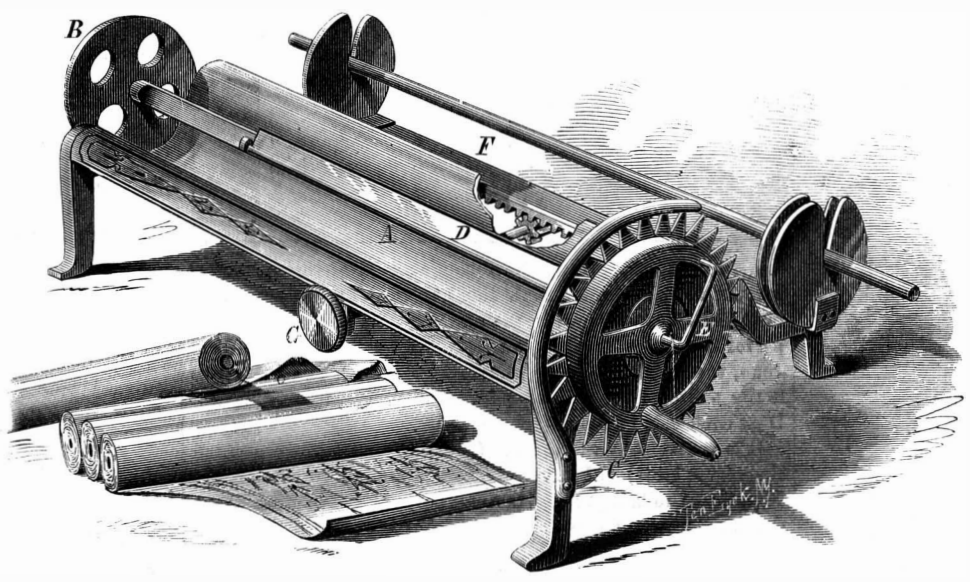
IMPROVED WALL PAPER TRIMMER.

We illustrate herewith a new and simple apparatus for trimming the edges of wall paper up to the printed line thereon. The cutting device is a small circular saw, and to its shaft an end of the paper is attached so, that the single operation of rotating said shaft drives the saw and feeds the paper to it. The cut, as we find by practical trials, is perfectly smooth, and as neat as if made by shears, while it is done with great rapidity, hardly a minute being required to trim a large double roll.

The frame is made of cast iron, and supported upon legs. One end of the roller, A, has its bearing in a fixed standard, while the other end bears in the standard, B, which is hinged to the frame, and can be turned down for the purpose of removing the roll of paper from the roller, A, after the trimming is accomplished. The journal of the roller in the stationary standard projects through the same, and a wheel is firmly secured thereon. This wheel is made dish shaped or flanged and surrounds the standard within. Upon the inner edge of the flange is secured the cutter, C, which is made in the form of a circular saw. One side of the roller, A, is made concave, and at one edge of such concavity is hinged a plate, D, by means of a rod which extends out through the journal of the roller to the outer side of wheel, where the rod is bent to form the handle, E. The plate, D, forms a clamp for fastening the end of the paper to be trimmed. It will thus be seen that the roller is the spindle on which the paper is rolled, and is also the shaft of the cutting device, whereby the machine is greatly simplified. The roll of paper to be trimmed is placed upon the shaft laid in two standards upon a movable carriage, F, sliding in guides on the rear part of the frame. The one standard is stationary on the carriage while the other is movable thereon, so as to be adjusted to the width of the paper placed on the shaft. On the under side of the carriage is a rack bar, into which gears a pinion on the end of a shaft, under the frame, extending to the front part thereof, and provided on its front end with a handle wheel, G, whereby the carriage may be moved to the right or left as required. After the roll of paper has been placed upon the shaft, its loose end is trimmed for two or three inches, either by the machine or hand shears, so as to enable it to pass the cutting device. The end is then inserted in the clamp and secured. By revolving the shaft or roller, A, the paper passes under and between the cutting device, and is trimmed and rolled upon the roller. The only care required while trimming the paper is to see that it is so fed as not to leave a white line or cut into the figure. This can be regulated by means of the wheel operating upon the carriage, as already described. By turning down the hinged standard, the trimmed roll is easily removed.

The machine is compact, while at the same time it is heavy enough not to need fastening down, so that it can be placed in any convenient position.

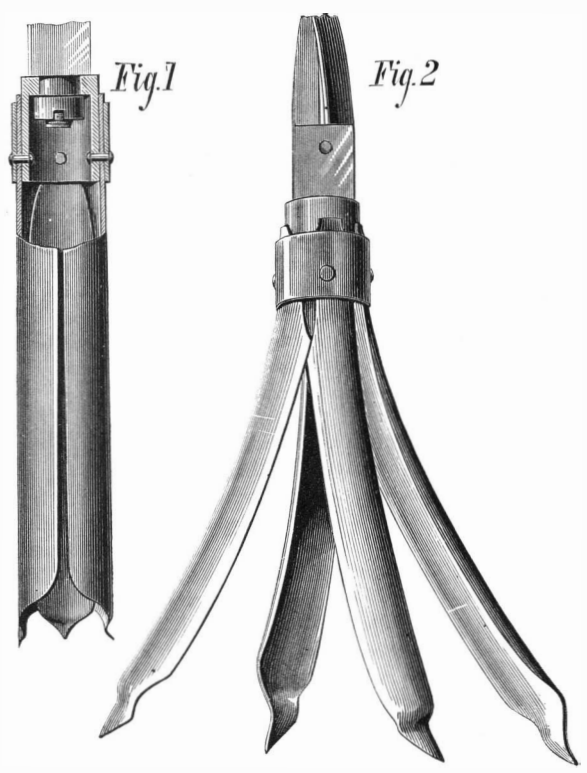
Patented December 7, 1875. For further information address Mr. Charles Boust, Northumberland, Pa.



BOUST'S WALL PAPER TRIMMER.

WESTON'S LIGHTNING ROD DISCHARGING POINT.

In order to render lightning rods of any efficacy as a protection to a building, it is absolutely necessary that the ground terminals shall be large, and sufficiently so to discharge all the electricity from the rod. The object of the device illustrated herewith is to secure an extensive metallic surface in contact with the earth, with comparatively little cost and trouble.

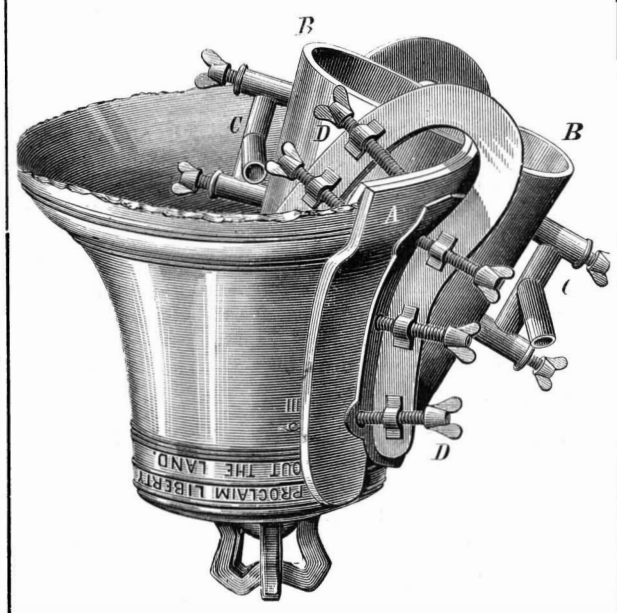


The device consists of four metallic arms, formed as shown and riveted about a central socket. When closed, the point appears as in Fig. 1. To attach it to the lower end of the ground rod, the pivot of the latter is inserted in the socket and the nut screwed on from the inside, as represented in the broken away portion in Fig. 1. A hole is then made in the earth with a crowbar, and the point, with the section of rod attached, inserted. When at the bottom, by forcing the rod down, the sheets or arms of the point will spread out as in Fig. 2, thus giving a large discharge area. The nut which connects the lower section of the rod with the point is left loose, so that the former is allowed to turn when screwing it into the section above. To attach the point to cables a zinc ring is first put on, then the discharger, and then another ring near the end of the rod. The discharger and upper ring are slipped back to their proper position and fastened with set screws.

Patented through the Scientific American Patent Agency, March 7, 1876. For further information address the inventor, Mr. J. H. Weston, 29 West Sixth street, Cincinnati, Ohio.

RIGGS' METHOD OF MENDING CRACKED BELLS.

Mr. Daniel L. Riggs, of Salem, Oregon, has patented (June 16, 1874) a new method of mending cracked bells, which, if we may judge from the testimonials submitted, has proved highly successful in many trials. The inventor proposes its application to repairing the Independence Bell at Philadelphia, and claims that he can render that historical object as good as new, and that its tones will ring out as clearly on July 4, 1876, as they did a hundred years before. The idea is simply to melt the metal at the crack so that the latter becomes closed by the fusion; and this is carried out by the novel arrangement of two furnaces and a mold, shown in the annexed engraving applied to the bell.



The apparatus is made in two portions, secured, one without and the other within the bell, so as to encompass the cracked part. Each section consists of a mold, A, of plumbago or fire clay, which exactly corresponds to the contour of the bell. On these molds are added walls, B, so as to form chambers or furnaces, to each of which air blasts are admitted and controlled by the system of tubes and check valves, C. At D are the clamps and hand screws by which the whole is held tightly in place. In the upper edge of the molds and just above the crack is a gate for adding molten metal. The furnace chambers being supplied with fuel and ignited, a blast is thrown into them until the edges of the crack are fused and united. Molten metal is then poured in in sufficient quantity to fill any deficiency which may be found to exist.

The Centennial Committee and others can, for further particulars, address the inventor as above.

SEVERAL years ago the Berlin Museum paid $24,000 for what were supposed to be Moabite antiquities. It has been discovered that they are not genuine.

Success in Milling.

John Griffith, a miller, gives his secret of successful flour grinding as follows, in *Leffel's Illustrated Milling and Mechanical News*:

"My burr is 26 inches in diameter, and has 15 leading furrows, with one short furrow to each leading one; the short ones one inch wide and very shallow. The chief secret is in the shape and condition of the furrows and draft. The stone being in face, running balance, and tram, the draft should be 1 inch to the foot in diameter of the stone; the width of the furrows should not be less than 2 inches for a 3 foot stone, pretty deep at the eye and taper out to the skirt to half an inch deep; it is then worked as smooth as possible with a pick and rubstone or emery wheel to a feather edge at the face. A stone dressed in this way will grind one third or one half more with the same power; and the same cloth will bolt it, and leave no clammy flour to clog the cloth. It bolts freely and the cloth is clean. I run about four bushels through the No. 9 cloth (6 feet in length and 29 inches in diameter), and return from 2 to 4 feet No. 10 in an hour. Grain does not want to be ground; what it needs is to be mashed and rubbed between the two smooth surfaces. Where the furrows are deep and rough, they will grind some too fine and some not fine enough, and throw out unground grain or unmashed particles. A grain of wheat is a bundle of fine particles; and if the bran or shell is broken and rubbed, it will be flour. I have ground 4,000 bushels of wheat since there was a pick on my burrs, and they run nicely yet."

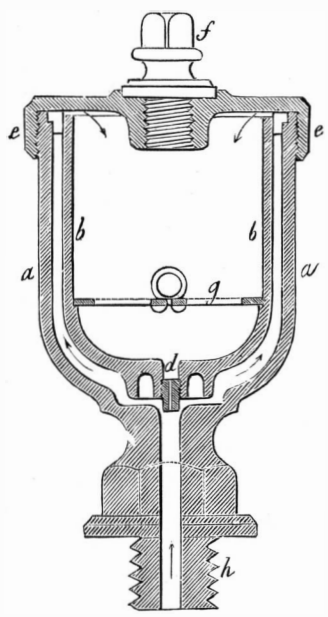
Foul Smells from Drains.

There is but one simple way, says a writer in the *Journal of Chemistry*, to prevent noxious emanations from cellar drains; and that is to start the drain pipes at the outer wall, and hang all the waste pipes from the cellar ceiling in plain sight, where the slightest leakage can at once be detected. These pipes had best be of iron, and in any ordinary building can be arranged to have a sufficient pitch towards the drain, without coming below the cellar ceiling enough to interfere with headway, and at the wall can be carried down perpendicularly into the mouth of the drain pipe, where the junction should be made tight with cement, and should be in plain sight. The best kind of drain pipes are of glazed stoneware with socket joints, and they be should laid in a bed of cement, and the joints made tight with the same. For common drains, a pitch or fall of one half inch in a foot is sufficient.

NEW AUTOMATIC GREASE CUP.

A sectional view of a new automatic grease cup, adapted to the lubrication of valve chests and cylinders, is represented in the annexed engraving, which we extract from the *Bulletin du Musée*. It consists of an exterior box, *a*, which terminates below in a screw shank, by which the apparatus is secured in place. Within the box is suspended a small receptacle, *b*, at the lower part of which is a small capillary tube, *d*, and above this a fine sieve, *g*. The top is hermetically sealed by the cover, *e*, a central orifice in which serves for the introduction of the lubricant (melted tallow), being closed by the screw, *f*. The receptacle, *b*, is filled with tallow until the grease begins to enter the screw aperture above. The object of the sieve, *g*, is to retain any impurities; and it may easily be cleaned by removing the core, *e*.

In operation steam enters the cup in the direction of the arrows, passes up above the receptacle, *b*, and presses upon the grease therein. At each momentary diminution of pressure, which takes place in the cylinder or in the valve chest at each change of stroke, a drop of tallow escapes at *d*, being forced down by the steam above. The apparatus is thus entirely automatic, giving a quick supply when the engine runs rapidly, and *vice versâ*, while the delivery stops altogether when the motion of the machine is arrested. This device is now in use on many locomotives on railroads in Saxony.



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ANIMAL FEROCITY.

The tiger has so long been deemed a beast that can only be feared and avoided, except by large parties of well armed men, that there is some sort of satisfaction in contemplating the masterly engraving which accompanies this article; and the dread grip which has seized the most terrible of marauders appeals strongly to our sense of justice. Mr. Joseph Wolf (whose genius may fairly be classed with the master spirits of animal painting, Landseer and Rosa Bonheur, although it is devoted to the comparatively humble work of drawing on wood for book illustration) has here given us a picture very characteristic of the wild animal life in the pathless jungles of the East Indies; and the powerful brute is shown in the remorseless hold of perhaps the only creature who can equal him in strength and ferocity. The elephant certainly now and then gores and tramples to death a tiger who may venture to attack him; but frequently the tiger is the master, and the bones of the "huge, earth-shaking beast,"

that hath between his eyes
A serpent for a hand,

are soon left to bleach in he sun. The crocodile of the East, however, is covered with an almost impenetrable armor of shell-like scales, the head being protected by a seamless horny integument; and its hold is not easily relaxed by the struggles, however powerful, of its prey. That it will ultimately tire out, drown, and devour the tiger) seems probable, and although crocodiles are little likely to elicit much sympathy from the human race, it is well to know that victory will not belong to the man-eating monster.

The engraving is the work of Messrs. J. W. and E. Whymper, and is published in "The Life and Habits of Wild Animals," issued by Messrs. Alexander Macmillan & Co., London.

A BENGAL TIGER ATTACKED BY A CROCODILE.

Diving for Drink.

One of the hottest regions of the earth is along the Persian Gulf, where little or no rain falls. At Bahrein the arid shore has no fresh water: yet a comparatively numerous population contrives to exist there, thanks to copious springs which burst forth from the bottom of the sea. The fresh water is got by diving. The diver, sitting in his boat, winds a great goatskin bag around his left arm, the hand grasping its mouth; then he takes in his right hand a heavy stone, to which is attached a strong line, and thus equipped he plunges in and quickly reaches the bottom. Instantly opening the bag over the strong jet of fresh water, he springs up in the ascending current, at the same time closing the bag, and is helped aboard. The stone is then hauled up, and the driver, after taking breath, plunges again. The source of these copious submarine springs is thought to be in the green hills of Omân, some five or six hundred miles distant.

The Richest Silver Mine in the World.

The Consolidated Virginia Mine is the most profitable in the world. During 1875 it yielded 169,307 tuns of ore worth $98 per tun, average, the total yield in bullion being $16,731,653.43. Since December 13, last, about 600 tuns of ore have been hoisted daily. As soon, however, as the connections with another shaft are complete, it is computed that this hoisting capacity will be increased to 2,000 tuns per day, or ore equivalent in value to $200,000. The superintendent of the mine says that, even under this great drain, there is enough ore in sight to last for many years. The almost fabulous amount of wealth which still lies buried, and which the drills of the miners have not yet exposed, cannot be conjectured.

Comparative Richness of Human Milk.

Mr. H. A. Mott, Jr., E.M., Ph. B., has recently read a paper before the New York Academy of Sciences, entitled "Comparison between the Milk of the African Race and that of the Caucasian." The author has conducted considerable research and has made numerous analyses, the result of which goes to show that the milk of colored women is richer in milk solids than that of white females. An average of 12 analyses of negro milk give water 86·34, milk solids, 3·66; this is compared (among others) with an average of 89 analyses by Vernois and Becquérel, of white woman's milk, which shows water 88·90, milk solids 11·09. The milk of the negro appears especially rich in milk sugar, fat, and inorganic salts. Microscopically examined, the two milks are similar with the exception that the negro milk contains a larger number of globules.

A White Light for Dark Room Windows.

At the last meeting of the Ghent section of the Belgian Society, Dr. Von Monckhoven communicated a very interesting and curious fact. Having to darken a room in which to dry carbon tissue, and having nothing on hand but red and green glass, and not enough of either to cover the window entirely, he used half of each, alternating it. The result was that at a certain distance from the window the red and green lights blended together and formed a white light. This white light has no action on the sensitized carbon tissue. If it should have no action on the sensitized collodion plate, it would be excellent to illuminate our dark rooms. If there should be no difficulty in procuring red and green glass which would transmit no rays having a chemical action, a window might be fitted alternately with red and green panes of small size.—*Photographic News.*

A New India Rubber Cement.

A good cement, that will render india rubber in any form adherent to glass or metal, is oft-times a desideratum with photographers, and in the *Polytechnisches Journal* for last month there is a simple recipe given for the preparation of such a compound. Some shellac is pulverized, and then softened in ten times its weight of strong ammonia, whereby a transparent mass is obtained, which becomes fluid after keeping some little time, without the use of hot water. In three or four weeks the mixture is perfectly liquid, and, when applied, it will be found to soften the rubber. We are told that the rubber hardens as soon as the ammonia has evaporated again, and thus becomes impervious both to gases and to liquids. For cementing the rubber sheet, or the material in any shape, to metal, glass, and other such surfaces, the cement is strongly recommended.

The Depth of the Sea.

At the last meeting of the Royal Society, Mr. Siemens, D.C.L., F.R.S., exhibited the instrument he has devised to ascertain the depth of the sea by a new means, without a sounding line. He has worked out the requirements, starting with the proposition that the total gravitation of the earth, as measured on its normal surface, is composed of the separate attractions of all its parts, and that the attractive influence of each volume varies directly as its density and inversely as the square of its distance from the point of measurement. The density of sea water being about 1 026, and that of the solid constituents composing the crust of the earth about 2·763 (this being the mean density of mountain limestone, granite, basalt, slate, and sandstone), it follows that an intervening depth of sea water must exercise a sensible influence upon total gravitation if measured on the surface of the sea. Mr. Siemens showed how this influence can be proved mathematically, in considering, in the first place, the attractive value of any thin slice of substance in a plane perpendicular to the earth's radius, supposing that the earth is regarded as a perfect sphere, of uniform density, and not affected by centrifugal force. It was in 1859 that Mr. Siemens first attempted to construct an instrument based on these principles. The difficulties he then encountered he has since overcome, and the present instrument is the result of his latest work. He proposes to call it a bathometer, and it consists essentially of a vertical column of mercury, contained in a steel tube having cup-like extensions at both extremities, so as to increase the terminal area of the mercury. The lower cup is closed by means of a corrugated diaphragm of thin steel plate, and the weight of the column of mercury is balanced in the center of the diaphragm by the elastic force derived from two carefully tempered spiral steel springs of the same length as the column of mercury. One of the peculiarities of this mechanical arrangement is that it is parathermal, the diminishing elastic force of the springs with rise of temperature being compensated by a similar decrease of potential of the mercury column, which decrease depends upon the proportions given to the areas of the steel tube and its cup-like extensions. The instrument is suspended a short distance above its center of gravity in a universal joint, in order to cause it to retain its vertical position, notwithstanding the motion of the vessel; and vertical oscillations of the mercury are almost entirely prevented by a local contraction of the mercury column to a very small orifice. The reading of the instrument is effected by means of electrical contact, which is established between the end of a micrometer screw and the center of the elastic diaphragm. The pitch of the screw and the divisions upon the rim are so proportioned that each division represents the diminution of gravity due to one fathom of depth. Variations in atmospheric pressure have no effect on the reading of the instrument, but corrections have to be made for latitude. The instrument has been actually tested in voyages across the Atlantic in the Faraday, and the comparisons with Sir W. Thompson's steel wire sounding apparatus showed it was very reliable. The paper concluded with pointing out many ways in which the instrument might be of use; among others, was that of indicating approaching danger, if contour lines were first efficiently mapped.—*London Times.*

A SIMPLE brown dye for cloth is made of japonica, ½ lb.; bichromate of potash, 2 ozs.; alum, 1 oz.; and water, 5 gallons. Put the ingredients in a vessel, dissolve, immerse the goods, previously wet with warm water, and simmer for three hours.

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ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Position of the Planets for April, 1875.

Mercury.

On the 1st of April Mercury rises at 5h. 14m. A. M., setting at 4h. 39m. P. M. On the 30th, Mercury rises at 5h. 23m. A. M., setting at 7h. 44m. P. M. Mercury is very unfavorably situated all through the month, as it is far from the earth, and its time of meridian passage is nearly the same as that of the sun.

Venus.

On the 1st of April Venus sets at 10h. 07m. in the evening, and on the 30th at 10h. 52m. The motions of Venus can be very easily followed during the month, as its course lies among the bright stars of *Taurus*. Its change of position at setting should be watched from night to night; it is farther and farther north all through the month.

Mars.

Mars rises on the 1st at 7h. 29m. A. M., and sets at 9h. 54m. P. M. On the 30th, Mars rises at 6h. 40m. A. M., and sets at 9h. 40m. P. M. Mars is small, but can be known by its ruddy light, and on the 1st of April it is very near Venus, and sets earlier than Venus.

Jupiter.

Jupiter rises on the 1st at 10h. 28m. P. M., and rises earlier and earlier every night, coming up on the 30th at about 8h. 21m. P. M., the star β^1 *Scorpii* rising at nearly the same time. On the 4th, this star and Jupiter are almost nearly together, but at any time during the first week of April the planet, its moons, and the star can all be seen at once in the field of a telescope of low power

Saturn.

Saturn rises on the 1st of April at 4h. 25m. A. M., and sets at 3h. 01m. P. M. On the 30th, Saturn rises at 2h. 37m. A. M., and sets at 1h. 20m. P. M. It will be seen that Saturn is above the horizon mostly in the daytime, and therefore is not well situated for observation.

Uranus.

Uranus rises on the 1st at 1h. 30m. P. M., and sets at 3h. 34m. the next morning. On the 30th, Uranus rises at 11h. 35m. A. M., and sets at 1h. 39m. the next morning.

Neptune.

Neptune, which can never be seen without the aid of a telescope, is at present very unfavorably situated, even for the best instruments.

Sun Spots.

The report is from February 22 to March 18, inclusive. In the photograph of February 22 was seen, on the edge, the last of the chain of spots mentioned in the last report. The pictures of February 25 and February 18 showed two small spots coming on. From February 26 to March 7 photographing and observations were interrupted by clouds; but the picture of March 7 showed faculæ, without any visible spot, on the edge, going off. On March 9 a small spot appeared on the eastern limb, and it was still visible, March 18, on the western limb. The picture of this date shows also a small group coming on, surrounded by faculæ, and two small groups near the center of the disk.

FIRE APPARATUS FOG ALARMS AND CORK MACHINERY.

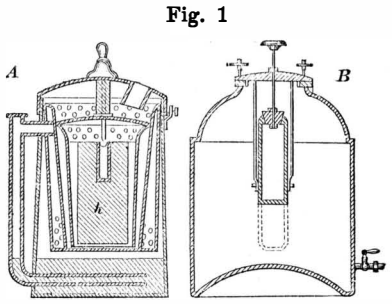
Mechanisms of the above named descriptions constitute our extracts from Knight's "New Mechanical Dictionary*" for the present week.

There are perhaps sixty patents for various forms of the fire annihilator. The devices particularly refer to the modes of construction, the acid and alkali chamber, and the method of mingling the gas-generating chemicals.

THE PHILLIPS FIRE ANNIHILATOR.

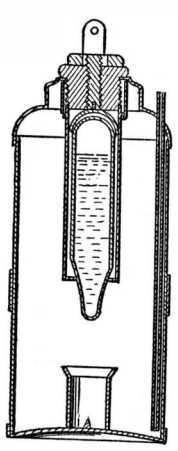
This invention was introduced into this country by P. T. Barnum, the enterprising showman, some twenty years ago. At that time the newspapers of the day were full of its praise. A number of experimental exhibitions were given in this and other cities, and for a time, through Barnum's management, the Phillips fire annihilator was the great sensation of the day. But we believe the great showman, after expending considerably more than his receipts in this venture, concluded that the introducing of new inventions from abroad into our country, which is so much in advance of all others in respect of novel devices, was not his forte; and he finally abandoned the annihilator enterprise and returned to the exhibition business, in which he has acquired both renown and profit.

Fig. 1



Fire-Extinguishers.

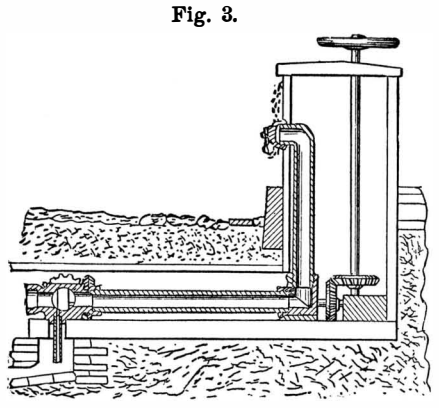
Fig. 2.



Fire-Extinguisher.

The annihilator is shown at A, Fig. 1; it was one of the earliest of these inventions. A compound of sugar and chlorate of potash is so placed as to receive the contents of a bottle of sulphuric acid, which is broken by striking a plug, on the top of the can, when a fire occurs. Around the perforate case which contains the mixture of sugar and chlorate is another case, and this is in a third envelope, between

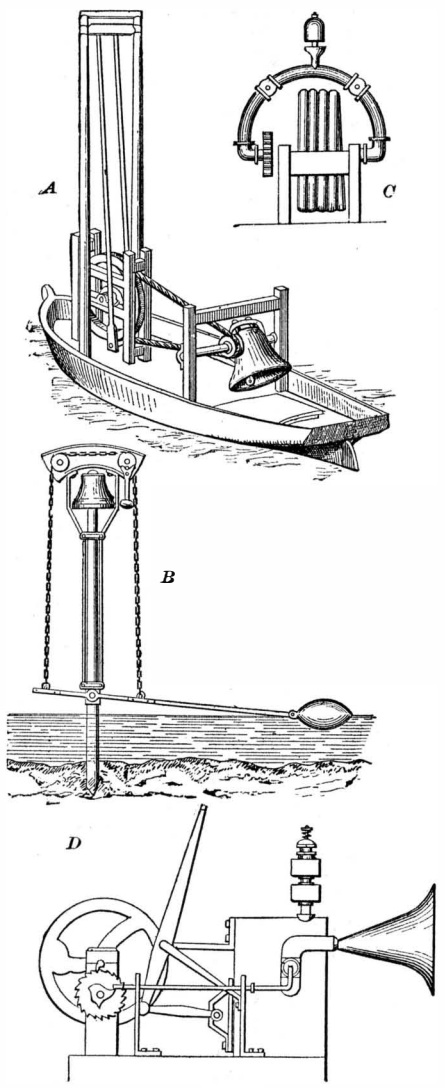
Fig. 3.



Fire-Plug.

which last and the outer shell is a water space. The carbonic acid produced by combustion passes out of the top of the machine, meeting on its passage out the water, which is raised in the side pipe by the pressure and heat of the chemical action, and which thus becomes saturated with the gas. A well known apparatus, now in the market, is represented at B. In this the sulphuric acid is in a leaden bucket hung upon trunnions below its center, so that, if set free, the bucket immediately turns upside down. It is kept rigidly upright, however, by a stopper attached to a rod passing through the cap of the apparatus. When the extinguisher is to be used, the stopper is pulled up by an exterior handle, when the bucket turns over and the acid and alkali are mingled, the reaction generating carbonic acid gas. The machine shown in Fig. 2 contains acid in a glass bottle, which

Fig. 4.



Fog-Alarms.

is shattered by dropping upon a stud, when forced below the flanges of the tin cylinder which holds it. An improved form of

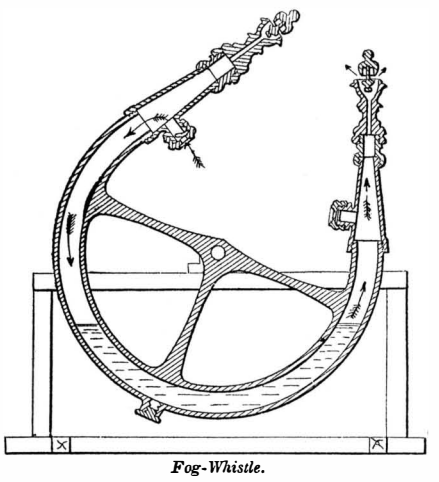
FIRE PLUG

is represented in Fig. 3. At the point where the branch pipe is coupled to the main, the stopcock is placed, and it is operated by gearing and connecting shafts from a hand wheel in the vicinity of the plug.

FOG ALARMS

are various in their kinds, their operation, and their construction. As shown at A, Fig. 4, the apparatus is erected on the deck of a moored boat, and a pendulous frame is arranged to be swung to and fro by the motion of the vessel. A bar on this frame actuates a wheel, which, by means of a pulley and belt, rings the bell. In B, the clapper is moved by a cam wheel actuated by chains, which run over pulleys as the float arm rises and falls on the waves. C has a spiral coil of tubing oscillating with the vessel. Each end of the spiral has a whistle and valve opening inward. The coil contains a quantity of water, which, in changing its position, forces the air out through the whistles, with a prolonged sound. In D the air is mechanically condensed and stored in a reservoir. The cam on the rotary shaft actuates the valve for the purpose of varying the sounds, to give a series of signals, more intelligible than single sounds repeated. A trumpet and whistle are attached to connecting pipes proceeding from the reservoir. The valve governs the air aperture in the

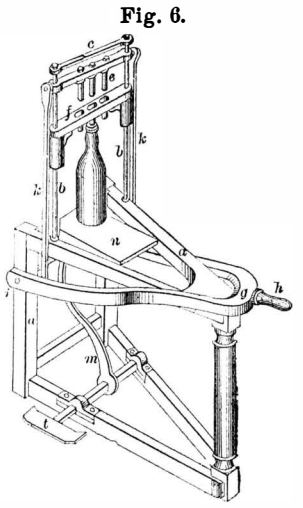
Fig. 5.



Fog-Whistle.

pipe leading to the trumpet. The fog whistle, Fig. 5, is similar in operation to the device, C, above. The vessel is tubular and semicircular; and as it is oscillated, air is forced out by whistles at its ends.

Fig. 6.



Masterman's Corking-Machine.

Fig. 6 is a

CORKING MACHINE,

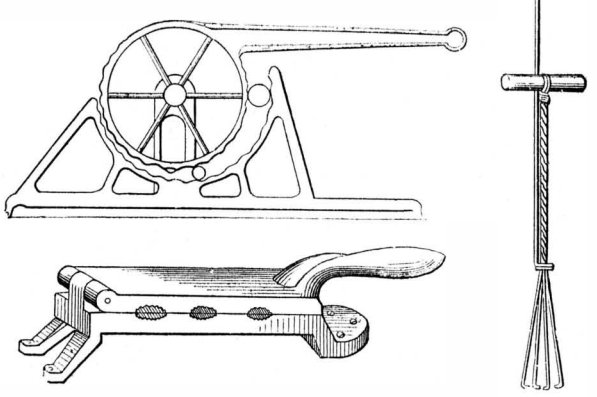
for inserting corks in bottles. The workman seats himself with one foot on the treadle, and the handle, *h*, in his right hand. He places a bottle on the wedge, *n*, with its neck beneath such one of the three tubes as will contain a cork of suitable size. Such a cork being placed in the tube, a motion of the treadle raises the bottle, and the depression of the lever, *h g*, drives the cork into the neck. Reverse motions of lever and treadle release the bottle. Two forms of

CORK PRESSES

are exhibited in Fig. 7. In the first, the cork is placed between the serrated surfaces of the concave and eccentric cam, and pressed to a less or greater extent by a partial rotation of the latter. The second form is simply a lever press with jaws. Fig. 8 is a

Fig. 8.

Fig. 7.



Cork-Presses. *Cork-Pull.*

CORK PULL.

The jaws, while collapsed by the slide, are passed through the neck of the bottle, and, being opened, are then clasped around the cork, which is then easily withdrawn.

DECISIONS OF THE COURTS.

United States Circuit Court---Northern District of Illinois.

TRADE MARK CASE.—THE TUCKER MANUFACTURING COMPANY *vs.* LEVI C. BOYINGTON.

[In equity.—Before Blodgett, J.—Decided October, 1875.]

BLODGETT, J.:

This is an application for an injunction to restrain the defendant from the use of the trade mark which has been registered by the complainant in the manner required by the Act of Congress. As the record now stands, I don't think this injunction ought to issue. It is a matter of discretion always with the court to issue an injunction or not, upon a case made in a trade mark suit. I cannot say but that the complainant may make a case upon final hearing that would entitle the complainant to an injunction; but it seems to me that it is not made as the record now stands. I have serious doubts whether the defendant infringes the complainant's trade mark. The words "Tucker spring-bed" were certainly common property from the date of the expiration of the Tucker patent in 1869. In January, 1875, the complainant, being the Tucker Manufacturing Company, and the party who had owned the patent during the lifetime of the patent, obtained the trade mark, which consists of a perspective of the Tucker bed bottom, with the letters "T. M. Co.," in monogram, in the center of the picture, and over it are the words "Tucker spring-bed." It strikes me very forcibly that this trade mark is for the combination, and the defendant does not infringe unless he uses the whole combination. The defendant, Boyington, had the right to use a diagram of the spring-bed as common property, and it has been such since the expiration of the Tucker patent.

It seems to me that while this may be a valid trade mark, when all used together, yet, when the defendant manufactures the spring-bed, he has the right to designate it as the "Tucker spring-bed," indicating that it is manufactured under the Tucker patent, and that he has, also, the right to

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put any colored label upon it that he chooses, so long as he does not, by his label, indicate that it is the manufacture of the Tucker Manufacturing Company. Now, the only semblance between the label used by the defendant and the plaintiff's label is that the defendant uses at the same time a perspective of the bed-bottom, and the words "Tucker spring-bed." He does not use the monogram, and uses nothing but what is common property. It is true that he uses the same colored label as the complainant uses. There is no patent trade mark upon the color. Either party has the liberty to adopt any color, green, blue, or all the colors of the rainbow; so that, as the record now stands, I think this injunction must be denied.

In passing upon a motion of this kind, which involves to a certain extent the merits of the case. I have, as far as possible, refrained from expressing any opinion that would prejudice the ultimate decision of the court. I think it is right that I should indicate the doubt I have, in order that counsel may determine for themselves whetner the case shall go on any further or not.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED GAS REGULATOR.

Joseph Desha Patton, Trevorton, Pa.—This consists of a hinged or pivoted and weighted gate resting on or against the current of passing gas, for the purpose of reducing the pressure and flow thereof. The device is claimed to be capable of nice adjustment so as to form a very efficient and sensitive regulator.

IMPROVED FLOUR MILL AND STAFFING DEVICE FOR MILLSTONES.

David Leib, Rich Hill, O.—In the mill, the novel feature is the combination of the bedstone with an adjustable flanged ring, having delivery spout and top casing to discharge at any desired point. The ring simply fits around the stone and is attached by fastening screws. The same inventor has devised an improved staffing device for millstones. This consists of a supporting plate, that may be attached to runner or bedstone, and provided with horizontal spring standards, that carry at their mortised front ends the bearers of the red staff, that is adjusted by set screws to the surface of the stone. The device is equally applicable to runners and bedstones, and is readily adjustable.

IMPROVED CAR STARTER.

Louis Funke, Champion Mills, New Mexico Ter.—This invention consists of a brake drum geared with the axle by a reversing train, and contrived with a spring for storing up the power exerted by the brake in stopping, so that, by shifting the gears after stopping the car, the spring will assist in starting.

IMPROVED TRUSS BRIDGE.

Joseph M. McDonald, Tomlinson, Ark.—This consists, mainly, in the construction of an arch made of laterally braced and bolted pieces of alternately interlocking timber, in combination with braced and longitudinally connected side and intermediate trusses.

IMPROVED DEVICE FOR RUNNING BELTS ON TO MACHINERY.

Eddy T. Thomas, Boston, Mass.—This consists of a spring hook or button that slides in a socket at the circumference of the driving wheel, and swings over the belt, so as to retain the same until run on the wheel, being then thrown off by the belt.

IMPROVED ARCH PLATE FOR STEAM BOILERS.

George Fox and George Fox, Jr., New York city.—In place of the solid cast iron arch plate of steam boilers, that is exposed to be burned through by the action of heat in the fire box, the present inventors propose a hollow arch plate connected to the boiler in such a maner that a constant circulation of water is kept up in the same.

IMPROVED BRICK MACHINE.

David Manley, Franklin, Pa.—In this machine is combined a large amount of new and ingenious mechanism for molding and pressing brick. It is so constructed that the three operations of filling the mold, pressing the brick, and removing the pressed brick may all be performed at the same time.

IMPROVED SAW MILL DOG.

Luke Buzzell, St. Johnsbury, Vt.—This is a dog for holding the log on the head block. It is mounted on a vertical screw having a quick pitch, so that it can be partly or wholly forced into the log thereby, and can be kept in so as not to work loose by the jarring and shaking of the mill. It is specially applicable to the dogging of frozing logs, in which the ordinary dogs will not hold at all.

IMPROVED COMBINED BOLT AND KEY FASTENER.

Edward H. Schnell, South Norwalk, Conn.—This is a contrivance of ingenious mechanism within the lock for fastening the key inside of the lock after it has thrown the bolt out, and also to fasten the bolt so that the key cannot be turned from the outside by nippers nor the bolt drawn back.

IMPROVED METHOD OF PROPELLING CANAL BOATS, ETC.

Louis F. A. Legouge, Wheatland, Cal.—A pair of push bars are here caused to push on each side at the same time, and without intermission, and through a reciprocating revolving motion the poles regain their working position with little or no friction. In order to prevent slip, the push bars are curved at the end on the front side.

IMPROVED MACHINE FOR BENDING SCYTHE SNATHS.

John H. Russell and George Birner, Milwaukee, Wis.—In using the machine, the wood to be bent is steamed, the movable part of the form is secured in upon the stationary part, and the cross bar is run back to the proper distance from the form. The timbers to be bent are then arranged with their larger ends in the cavity of the cross bar, and their smaller ends in the cavity of the form. The cross bar is then forced forward by turning a screw, pressing the timbers into the form and giving them the desired shape. The cross bar is then run back, pins are withdrawn, the moving part of the form is detached, taking the timbers with it, and the said part and the timbers are taken to the drying room.

IMPROVED CAR COUPLING.

Duncan MacDougald Campbell, Holly, Mich.—This invention consists in a spring attached to truck and bottom of car, in the rear of the buffer frame, to take up the strain of back pressure, and thus prevent injury to the king bolt; also, in a check attached to the truck and stiffening bar of the buffer frame.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED HARNESS HAME.

Benjamin F. Haviland, Danville, Vt.—This is a contrivance of the rein guides of hames, whereby the rein can be shifted higher or lower, and inward or outward, to meet the requirements of different horses. It is simply an arrangement of one or more upper and lower and outwardly projecting rein guides, additional to the ordinary rein guide.

IMPROVED MACHINE FOR TENONING SPOKES.

John G. Peace, Salem, Mo.—This spoke-tenoning machine may be applied to the ends of the spokes after they have been driven into the hub, so that the wheel may be finished without moving it from place to place. It consists of a spring auger, that is guided in a suitable supporting piece, which is rigidly clamped to the spoke, producing the exact tenoning of the spoke end by turning the auger.

IMPROVED SASH HOLDER.

Charles E. Steller, Milwaukee, Wis.—This consists of a circular grooved disk encircled by an elastic band, and pivoted eccentrically to the sash, so as to act as a wedge to hold the latter against the casing, and so sustain the sash at any desired point. This invention was described and illustrated on page 166, current volume.

IMPROVED DIE FOR MAKING CARRIAGE BODY LOOPS

John Garvin, West Meriden, Conn.—This invention consists in two sets of dies, consisting of the forming dies, made with recesses to form the lug, head, and prong. The finishing dies are made with recesses, and there is a projection to finish the loops and form the countersink for the bolt head.

IMPROVED HARNESS TUG.

Charles Franklin Towsley, Brinkley, Ark. This invention consists of a metal loop for suspending the thill of a buggy from the back strap. Said loop has a latch piece to open for admitting the thill and closing it in; and also a lining of soft material in the bottom, to avoid wearing the thill. Suitable connections are added for suspending it from the back strap and connecting the girth.

IMPROVED WHIP SOCKET.

William Hughes and Joseph K. Alexander, Minerva, O.—This whip socket is so constructed as to enable the whip to be locked in it when desired. It is a combination of a coiled spring and a lock with a whip socket made in two parts, turning upon each other.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED CARTRIDGE.

Albert Hall, New York city.—This consists in securing the anvil by projecting points in recesses of the shell of a shot gun cartridge, and holding the same by a sheet metal cap piece at the base of the shell.

IMPROVED BOTTLE STOPPER.

Charles de Quillfeldt, New York city.—This consists of an elastic stopper applied to a solid cap piece, and hung by a curved slot to a yoke pivoted at the neck band. A lever bail, pivoted to the cap piece below the slot, acts on the yoke, and raises it to the uppermost part of the slotted cap piece, to secure thereby the stopper to the neck.

IMPROVED RAILROAD RAIL JOINT.

George N. Hodgdon, Enfield, N. H.—This inventor proposes, as an improvement in rail joints, the combination of the rails, which are laterally braced at their meeting ends, with longitudinal sleepers, that extend on both sides of the joint, and are bound by the cross ties at both ends to provide a steady, continuous bearing for the rails.

IMPROVED SUSPENDER STRAP.

Francis E. Johnson, New York city.—This inventor makes the button straps on suspenders of woven webbing; and instead of carrying them directly through a ring on the braces, he attaches them to a piece of leather looped through the ring. The straps may be either in two pieces or in one; in the latter case, they are folded diagonally at the point of attachment to the ring connection. Said connection is covered with satin jean, which obviates the staining of the shirt by the leather. The device is simple and strong, and is both convenient and comfortable for the wearer.

IMPROVED BALE TIE.

Stephen Callanan, Castleton, N. Y.—This consists of a ring bent on one end of a wire, and a hook on the other, such as are employed in a weaver's knot, together with a bend on each wire at the point where the ring and hook begin, or thereabout, in such manner that the hook may be passed through the ring, hooked around the wire above the ring, and then drawn back into it, forming a substantial knot.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FLAIL.

Theodore F. Drake, Great Valley, N. Y.—This inventor proposes a light bundle of wires as a substitute for the heavy metal shod flail beater ordinarily used. He considers this device to be just as effective as the latter and much less costly.

IMPROVED SEED DROPPER.

Hermann H. Koeller, Camp Point, Ill.—This improved device for dropping seed is so constructed that it may be readily adjusted to drop larger or smaller seeds, as may be required, and will prevent the dropping slide from carrying out any more seed than enough to fill the dropping holes of said slide. It consists in combining a centrally pivoted two armed spring with a cut-off block, and in making the cut-off of a side-slotted box, a block with side pins, a spring, a bolt, and certain angle plates.

IMPROVED SPRING LOCK FOR PLOWS.

Milton K. Wheat, Paris, Ky.—The object of this invention is to hold the plow plate of cultivators, drills, and shovel plows in place when at work, in such a way that, should the plow plate strike an obstruction, it will swing back and thus prevent it from being broken. The device consists in spring lock bars, provided with shoulders at their upper ends, pivoted to the plow beam or the plow standard, and having the plow plate attached to their lower ends.

IMPROVED STRAW CUTTER.

William H. Harrison, Clay Village, Ky.—This consists of a cam contrivance combined with a curved cutter having a rocker-shaped end, and a roller at each end of the rocker to work in the cam as a substitute for the ordinary pivot. The object is to contrive a connection of the cutter that will not be subject to the lateral play of the cutter common to the ordinary pivots, and which will give a shear cut throughout the whole swing of the cutter.

IMPROVED REAPER AND MOWER.

Marvin W. Freeman, Beatrice, Neb.—The invention consists in sickles concaved upon their inner sides, and provided with sickle teeth, and in the combination of the stationary adjustable sickles and their bar with the vibrating sickles and their bar, and with dividing fingers and the cutter bar. By using two sickles, serrated, matched, and concave, right and left oblique edges are made to work in close proximity with each other; while by making the upper sickle section longer than the lower one, the whole weight of the former is made to bear on the heel thereof, the main bar and bevel edges of lower sections thus retaining the edges close together until worn out.

IMPROVED HOG SCRAPER.

Peter Johnson, Wauconda, Ill.—This hog-scraping tool is formed of a handle, with circular and elliptical concavo-convex scrapers secured to its respective extremities. The conformation of the blades admits of all portions of the body being equally reached, and hence of the scraping being more effectively performed.

IMPROVED SELF-RAKES FOR REAPERS.

Abner S. Smith, Hannibal, Mo.—This is an improved rake for attachment to harvesters and reapers to remove the cut grain from the platform, and deposit it in gavels upon the ground. The novelties are mainly improvements in construction, requiring the aid of drawings for their proper description.

IMPROVED PORTABLE FENCE.

Levi Chipman, Vermont, Ill.—This is mainly an improved fence post, which may be quickly set up and taken down, and which requires neither nails, keys, wedges, pins, nor bolts for connecting the panels thereto. It is formed of inclined bars, a notched sill and crossbar, made in two parts, and an upright bar. With this are combined the projecting ends of the horizontal bars of two adjacent panels, placed at an angle with each other.

IMPROVED SCRAPER ATTACHMENT FOR PLOWS.

Eugene Slosson, Morris, Ill.—The scraper plates have arms which are pivoted to the standards. The ends of the arms are fastened by wooden pins strong enough to withstand the draft strain under ordinary circumstances, but which, should the scrapers strike an obstruction, will break and allow the scrapers to swing back. The pitch of the scrapers is adjusted by wedges, and there are other useful and novel improvements in construction.

IMPROVED CULTIVATOR.

Thomas J. Montgomery and George W. Montgomery, Winchester, Tenn.—The standards are curved outward to bring the plows at the proper distance apart, and then downward, and their lower parts are curved forward to form seats for the plows. There is a new arrangement of braces attached to the standard for sustaining the draft strain, and a bar is provided which acts as a guard to keep the machine erect and cause it to run steady and smooth, and as a gage to regulate the depth to which the plows may enter the ground.

IMPROVED CHURN.

John T. Brown, Morrisville, and J. W. Colbert, Fredricksburg, Va.—The invention consists of a churn wherein there are two dashers revolved in opposite directions, to produce conflicting currents; also a bearing plate between the cover and an inner shoulder of the churn body, the same being arranged so as to form both a bearing for the dasher shafts and a guard against the exudation of the milk or cream: also a collocation of mechanism with cover, so as to make a single detachable piece.

IMPROVED PLOW.

Henry D. Straight, Denmark, Iowa.—This plow is so constructed that the depth at which it works in the ground may be controlled entirely by the handles. The landside part of the mold board is bent forward to serve as a colter to cut the soil, instead of tearing the same, as is ordinarily the case.

IMPROVED PORTABLE FENCE.

Tilmon A. H. Cameron, Petra, Mo.—The panels of the picket fence are formed by inserting and securing the pickets in holes in the top and bottom rails. The adjacent ends of the top and bottom rails of the contiguous panels are overlapped, and through them are passed round pickets, which have heads formed upon their upper ends to prevent them from dropping through the said rails. The panels are supported away from the ground by the device, in which a notched sill receives the bottom rail of the panel, and the ends of which are secured to braces. The fence is easily leveled upon inclined or uneven ground.

IMPROVED CHURN.

Robert M. Neal, Belle Plaine, Kan.—The object here is to throw the milk into violent agitation, so as to bring the butter in a very short time. This is effected by using both a dasher moving up and down, and beaters revolving in opposite directions, the whole operated by novel and simple mechanism.

NEW HOUSEHOLD ARTICLES.

IMPROVED NURSERY CHAIR.

Lewis P. Lawrence, Port Morris, N. J.—This is an ingenious article of furniture, so constructed that it may be arranged for use as a child's high chair, as a low chair and table, as a low rocking chair, and as a low stationary chair.

IMPROVED WASH TUB STAND, CLOTHES HOLDER, AND IRONING BOARD.

John J. White, Norfolk, Va.—This invention consists in constructing a hollow stand so that it may receive the soiled clothes, hold the wash tubs, and support the ironing board; also in providing opposite inwardly inclined ledges to receive the wash tubs as well as bottom sections, and to sustain the ironing board; also in novel means for holding the bottom sections of the stand in a secure and stable position.

IMPROVED TABLE LEAF SUPPORT.

Eli J. Wolfrom, Washington, Ohio.—The invention relates to modes of supporting hinged table leaves, and consists in so doing it that the support will be automatically thrown into true bracing position by the act of raising the leaf, and, at the same time, effectively locked against the possibility of displacement.

IMPROVED WASHING MACHINE.

Thomas H. Peavey, Epworth, Iowa.—The essential feature here is a contrivance of the apparatus for working a swinging washer in a box-shaped tub, so that the projecting portions may be readily detached and stowed away. A table top may be put on the top of the tub, and thus the machine may be utilized for a table when not required for washing.

IMPROVED KNOB LATCH.

William W. Gardiner, New York city.—This lock is so constructed that the key may be inserted through the knob and spindle that operate the catch bolt.

IMPROVED HEAT RADIATOR.

Emerson C. Angell, New York city.—This is a combination of tubes, rising from a continuously open draft flue, that has a valve near each end, provided with valves just above said flue, and above these valves connected by cross pipes, so that all the flues will empty into a continuous tube, being thus easily cleaned, and a direct or indirect draft being secured. The invention presents a large radiating surface, while tending to economize fuel.

IMPROVED FOOT-WARMING STOVE.

Edwards A. Reed, Oliver Springs, Tenn.—The invention relates to providing the outer box of the foot stove with braces for supporting the chimney, and forming a handle by which to carry the same. The furnace may be withdrawn by a handle from the casing, and used in detached state for cooking purposes, which may be of considerable advantage in traveling.

IMPROVED CANDLESTICK.

Philipp Schauble and Louis Dohm, Elizabethport, N. J.—This consists of a coiled wire fixed upon a suitable base to serve for the tube of the ordinary candlestick. The upper end terminates in a hook for hanging it up readily, and there is a cup for the bottom of the candle, with a stem projecting out from it through the space between the coils, to raise and lower the cup by screwing it up and down, and to serve for a handle for carrying the candlestick about.

IMPROVED IRONING TABLE.

Jacob Closs, Decatur, Ind.—This is a new ironing board, so constructed that it may be readily attached to an ordinary table, and provided with a small board, which may be swung over the large board and secured for use, and swung back out of the way when not required.

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Responsible parties who will make, on royalty, a Pat'd Corn Planter, address A.C. Burgner, Charleston, Ill.

Castings for low pressure beam Engine, about 2 in. bore of cylinder, address P.O. Box 247, Albany, N.Y.

Canadian Patent on a Life-Preserving Stool, for sale cheap. H.H. Nash, 223 So. Eutaw St., Baltimore, Md.

Companies engaged in casting "cast steel" may secure a desirable contract by sending their catalogues of prices to Post Office Key Box E E, Macon, Ga.

Traveling Crane at half price—8 tuns lift with 2 men—12 feet high, 25 feet tread, $425, f. o. b. cars. Mitchell, 310 York Ave., Philadelphia, Pa.

Wanted—The address of parties who manufacture machinery for making paper pulp from wood. H. H. Frary, Jonesville, Vt.

Split-Pulleys and Split-Collars of same price, strength, and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

For Best Band and Scroll Saws, Universal Wood Workers, Planing and Matching Machines, address Bentel, Margedant & Co., Hamilton, Ohio.

Patent for Sale, on royalty—Road Engine. A valuable Machine for hill grading as well as on level. Address J. Henry Bange, Edwardsville, Ill.

Family Knitting Machines—Alfred L. Lincoln, Knox P.O., Pa., wishes the best kind made.

Best Speed Indicator. Mail $2. Write for discount to Agents. Samuel Harris, Lind Block, Chicago.

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Sure Cure for Slipping Belts—Sutton's Patent Pulley Cover is warranted to double the power of any pulley. Circulars Free. Agents Wanted. John W. Sutton, 95 Liberty St, New York.

Patent for Sale—A Water Wheel two inches in diameter, in a case three (3) by five (5) inches, for running Sewing Machines, &c., using very little water. Larger sizes can be built. Address C. H. Sturges, Saratoga Springs, N. Y.

For Sale—36 in. x 16½ ft. Lathe, $400; 31 in. x 10 ft. Lathe, $300; 18½ in. x 12 ft. Lathe, $250; 15 in. x 8 ft. Lathe & Chuck, $175; 9 ft. Planer, $425; 6 ft. Planer, $350; Profiling Machine, $350. Shearman, 45 Cortlandt St., N. Y.

Small Launch Engine, 3 in. x 3½ in. Link Motion, cheap for cash. H.R. Sillman, 160 Smith St., Brookl'n, N.Y.

M'f'rs of Shafting, Pulleys and Hangers, address, with lowest price list, the Dueber Watch Case Manufacturing Co., Cincinnati, O.

Walrus Leather and Walrus Leather Wheels for polishing. Greene, Tweed & Co., 18 Park Place, N. Y.

Wanted—A good 2d hand Steam Engine, Cylinder 18 in. x 36 in.; Band Wheel, 12 or 13 ft. x 26 in. face. Address, with full particulars, N. W. Robinson, P. O. Box 775, Burlington, Vt.

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For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., NewHaven Conn.

Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

All Fruit-can Tools, Ferracute W'ks, Bridgeton, N.J.

Notes & Queries

E. J. T. will find directions for painting tin roofs on p. 202, vol. 30.—G. D. can remove colored writing ink from paper by the process given on p. 410, vol. 32. Water may be purified by the process given on p. 387, vol. 33.—S. H. will find a description of a process for canning green corn on p. 234, vol. 33.—G. G. M. P. will find a description of a tracing machine (pantagraph) on p. 179, vol. 28.—W. R. will find directions for using the lactometer on p. 208, vol. 34.—C. O. R.'s device for improving a vertical boiler is not new.—W. E. S. should address Seth Green, Esq., Rochester, N. Y., as to trout culture.—J. A. G. can ebonize wood by the process described on p. 50, vol. 33. Shirts may be highly finished by the method described on p. 213, vol. 34.—H. P. S. will find directions for silver-plating without a battery on p. 399, vol. 31.—W. F. R. is informed that the sparks from a leather belt in motion are electricity. See p. 10, vol. 34.—C. M. will find a recipe for filling for wood on p. 315, vol. 30.—P. B. T., G. M. G., S. H. W. J. K., B. L., and H. T., who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns all. of whom are trustworthy firms, for catalogues,

(1) J. L. W. says: If we use a plain iron pipe in drive wells, in some localities, it will run into holes in about one year; in others it will last a little longer. Why does the pipe not wear out sooner than the pipe 8 or 10 years ago? A. The new pipe may be driven through dissimilar strata of earth, and thus subjected to different conditions from the old; or the old may have holes in it also, but the rust and compact earth around it close them so that they do not show. Rubber coated pipe is now used for gas when laid in the ground, and might be serviceable for drive pipe.

(2) J. E. M. asks: Will it do to cement on soft sand walls in a cistern? A. Dig your cistern in a circular form and cut the sides as true and smooth as you can; put on the cement all in one coat about one inch thick, and float it down to a very smooth surface.

(3) E. A. V. says: A refrigerator is built of brick. It is 4 feet square, and 5 feet 6 inches high inside. The wall is 10 inches thick, having a hollow space of 2 inches wide in the wall. It is cemented on the inside. The room has no ventilation, and the ice melts very fast. How can it be made to work? A. The heat is most probably derived from the earth at the bottom of the refrigerator, and through the brick wall, where the isolation is not perfect. A wooden lining set off from the wall 2 or 3 inches, and up from the bottom the same, and a little ventilation, would most likely improve it.

(4) S. & P. M. Co. says: In the manufacture of artificial stone from Portland cement, we use wooden molds and coat them with shellac varnish; but it becomes soft in a short time. Is there anything that we can coat them with that will become hard and resist the action of the cement? A. Glycerin is sometimes used for plaster molds, but more usually a mixture of lard and oil.

(5) F. N. R. says: Please tell me how I can make a good galvanic battery without many cups. A. Get a glass jar, and at the bottom of it place a circular piece of copper to which a gutta-percha-covered wire has previously been attached. Let the wire be long enough to extend five or six inches out of the jar. Fill the latter, about two thirds full, with water, in which a quarter of a pound of zinc sulphate may be dissolved. Then suspend a piece of zinc in the jar so that its upper surface is just below the level of the water. When this has been done, drop crystals of copper sulphate (blue vitriol) in the jar, taking care that none remains on the zinc. About half a pound will be enough to start the battery; more may be added from time to time as needed, but care must be taken that the blue does not extend quite up to the zinc. A wire leading from the zinc and the one from the copper form the poles. The number of cells required for any given case, as well as their arrangement, will depend upon the work to be done.

(6) J. B. asks: Can shellac be dissolved in sulphuric ether by heat? A. No. It can be dissolved by the alkalies and by aqueous solutions of borax.

(7) H. S. J. says: 1. Please give me the value of paraffin as an insulator, counting shellac as 1,000. A. We do not recollect ever having seen a statement of the relative values, but believe that paraffin stands a very little below shellac as an insulator. 2. In the chloride of silver battery described on p. 390, vol. 33, do you mean that each cell is equal to 1·03 of Daniell's? A. Yes. 3. How many cells of this battery would be necessary to produce a powerful electric light? A. That depends upon the resistance of the battery, which, we believe, is high; consequently the number of cells would be considerable. We have, however, never experimented with it.

(8) E. W. asks: Is there an equal amount of fertilizing material in old dry bones and in green ones? A. The difference is in the loss of nitrogenous compounds arising in the decomposition of the fatty and other matters. The percentage of phosphate of lime in the two cases is the same.

(9) T. K. asks: Do wire hair brushes make the hair stiff and harsh? A. The excessive use of a stiff brush should be avoided, as it irritates the scalp and promotes the formation of dandruff. We have found that thorough cleansing of the hair with tepid water and pure white Castile soap (the soap being completely removed by rinsing with pure water) once in two or three weeks, and thoroughly rubbing the scalp and roots of the hair with hair oil, will keep the head clean and the hair soft and free from dandruff.

(10) J. A. G. says: What can I use to prevent the disintegration of rubber hose? A. Try the following: Flow the interior of the tube with a solution of strong glue in water, and immediately afterwards with a strong solution of tannic acid in water. India rubber is partially dissolved by kerosene oil.

(11) A. B. asks: What is the reason of the heat produced when lime and water are mixed? A. When two liquids or a solid and a liquid combine to form a solid body, the action is always accompanied by a considerable evolution of heat. As might be expected, the contrary is the case when a solid passes into the liquid form, as in the case of ice and salt. When caustic lime is mixed with about one half its weight of cold water, the lime and the water combine to form a white dry powder (which is the hydrate of lime), and the heat that is evolved by the chemical combination is often sufficient to ignite gunpowder.

(12) C. P. says: In November last I was traveling in the west, and the prairie fires had spread over hundreds of square miles, and the ground was black. During the bright daylight, the ground was continuously spread over with a gossamer covering of spiders' webs for miles and miles. Whence came the multitude of insects that spun the webs? A. The fire had been superficial and would not have destroyed the germs of vegetable and animal life concealed beneath the surface.

(13) F. W. G. asks: What is the best method of polishing hard rubber? A. Use pumice-stone and rottenstone. Some varieties of hard rubber goods are given a natural polish by the presence in their composition of bodies similar to asphaltum.

How can I stain pearl to an color? A. We have never heard of this having been done.

(14) W. W. B. asks: How many lbs. of marble does it take to make 100 cubic inches of carbonic acid gas? A. About 200 grains.

(15) B. G. asks: 1. Please tell me the amount of correction to be applied to an aneroid barometer for an altitude 6,000 feet above sea level. We have a mercurial barometer from which to make the adjustment. A. The adjustment is best made directly from the mercurial barometer itself. Graduate your aneroid according to the readings of the mercurial, or (by observation) make a table of comparative values. 2. Water boils here at some 11° below the temperature required at sea level. By the same rule, should water freeze at a different temperature than at sea level? A. The freezing point is not displaced in any appreciable quantity.

(16) A. B. says: Galvanized iron nails throw the putty when the latter is made of lead. Would a putty made of zinc do better? A. Yes, try it.

With what, better than with white lead paint, can wood be coated to render it impregnable to water? A. Fill the pores of the wood with a good covering of shellac varnish.

(17) B. V. P. asks: Is there any way to avoid the use of sulphuric or other acid in wire drawing? A. The acid pickle may be omitted, but if so the tool is in danger of being rapidly corroded by the scale of oxide formed on the surface of the wire during the operation of annealing. Wash your wire immediately as it comes out of the pickle in alum water, and dry as quickly as possible. This method, if the acid used is free from copper, will, in most cases, be all that is required. Another method is that of neutralizing any of the acid liquor that adheres to the wire after removal from the pickle by means of a weak lye, washing with water, and drying quickly. The wire should not be allowed to remain, while moist, in contact with the air any longer than possible. Sawdust may be used for absorbing the moisture, but in some cases it will be found advisable to employ good lime instead.

(18) J. W. L. asks: What cheap stuff can I use to dye hemp or feathers to a deep red or scarlet color? A. Use aniline red.

(19) T. W. A. asks: Can you give me any information in regard to the manufacture of illuminating gas from fine sawdust? A. Very rich illuminating gas may be obtained from wood by subjecting it to destructive distillation in retorts similar to those employed in the production of coal gas. It has been found necessary, however, in order to convert the empyreumatic vapor that first passes over into a permanent gas, to pass the vapor through tubes heated to redness. The gas thus obtained contains a larger proportion of carbonic acid than coal gas, and consequently requires a larger percentage of quicklime for the elimination of this impurity. It is, however, free from sulphur and ammonia compounds. Wood gas requires larger burners than coal gas because of its greater specific gravity. If this precaution is not taken, the luminosity of the gas flame will be greatly reduced.

(20) J. M. N. asks: What is the best way of protecting the iron bottom of an aquarium from rust? A. Mastic varnish will answer the purpose very well.

(21) S. W. N. asks: What is a good stove polish? A. The best stove polish is the purest graphite, ground very fine and mixed with a little alcohol or vinegar; the addition of other carbonaceous substances only injures its polish and refractory qualities. The plumbago now employed is in many cases adulterated with finely pulverized gas carbon, which, although it resists high temperatures, detracts greatly from the polish.

(22) P. A. says: If I have an inverted siphon, one end being larger than the other, filled with water and closed at each extremity with a closely fitting piston, and a weight or pressure of 100 lbs. be applied to the larger end, what will be the amount of pressure at the smaller end? If applied at the smaller end, what will be the pressure at the larger end? A. The pressure per square inch will be the same at each end of the tube, so that the total pressure will be in proportion to the area.

(23) H. B. asks: How can I make the mixture of clay that is used in the place of firebrick for stoves? A. Fire clay is a common article of trade. When required for use, it is mixed with with a little water, kneaded into a thick dough, and used at once. The clay is sometimes mixed with a little plaster of Paris, and alum water is occasionally employed in place of clear water.

(24) J. M. asks: Is there not a method by which rock can be blasted by electricity? A. Not by electricity alone. Gunpowder and gun cotton can be fired by electricity, and dynamite and nitro-glycerin by a suitable percussion cap ignited by an electric current.

(25) J. D. G. says: 1. I wish to warm several chambers and a bath room. Is it practicable to do it with 1 inch iron pipes of water, passing through 2 stoves with constant fire, water being supplied from a barrel on the second floor, passing down to stoves on first floor, thence up to the chambers, and back to the barrel? A. It can be made to work if properly set. The pipe in the stove should be in a spiral coil, the water from the reservoir entering at the bottom and the warm water passing out at the top; set the coil against the lining of the fire chamber, and let the coal lie in against it. The reservoir should be 4 or 5 feet higher than the highest part of the pipe, and the pipe so set that the water will all drain back to the lowest point at the stove, where a faucet should be provided to discharge it when required. A coil from the same pipe could be placed in a second stove, providing regard is had to discharging the same as above. The water in the reservoir will become heated, and with proper pipes could be supplied to the bath tub, etc. 2. What surface of pipe would be needed in each 100 cubic feet of space in the rooms? A. One foot of radiating surface to every 50 to 100 cubic feet of air, according to the conditions of exposure to winds, etc.

(26) L. P. L. asks: What is best to prevent sourness in mucilage made of gum arabic and water? A. Try a few drops of oil of cloves.

(27) A. O. W. asks: 1. Does wind affect a thermometer? A. If the glass bulb of the thermometer be perfectly dry, its indications will be the same whether the surrounding air is in motion or at rest. The truth of this is very easily demonstrated by experiment. If we moisten the bulb of the thermometer, however, we shall find that the temperature indicated will be decidedly lower when the air is in motion than when at rest. The difference in the indications is dependent upon the rapidity with which the water on the exterior of the bulb is evaporated. The analogy between the human body and the wet bulb thermometer in this respect is obvious. 2. How much colder is it at the surface of the earth than 5 feet above, in the shade? A. Practically the difference is very slight, and the difference is by no means uniform. 3. How can I make a rain gage? A. The cheapest form of rain gage we know of is that composed of a graduated bottle, having a narrow neck with a perforated stopper, through which passes the leg of a glass funnel, the mouth of which is of known area. For one of the best forms of pulviometer, see p. 150, vol. 34.

(28) A. L. S. asks: How can I make a good liquid acid for soldering iron? A. Dissolve zinc in hydrochloric acid until it will hold no more.

(29) B. asks: Is it possible for a lady to attain proficiency in the arts of engraving, etching, and carving without a master? A. There are many artists of both sexes who, having natural ability, have made great progress in these arts with little or no instruction except what is gained from books and diligent practice. The demand for art workers is increasing, and is likely, in the future, to be great enough to insure remunerative employment for really capable persons.

(30) W. X. C. asks: How can I wash printer's rollers? A. When printing ink was made with burnt linseed oil, as it should be, a little pearlash lye would clean any roller fresh from the press, and dried ink could be removed with a little turpentine. But the inks of the present day are many of them, made with mineral oil: and caustic lyes and petroleum benzine, with much labor are required to clean rollers or type.

(31) F.E.H. asks: What size of wire is best for a magnet (½ inch core) to ring a small bell? A. No. 18 copper wire will be found about right.

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(32) W. P. D. says: 1. What should the power of the telescope of an ordinary spectroscope be? A. That depends upon the class of work required. 2. What should be the length of the collimator tube? A. It should be the focal length of the lens for parallel light. 3. What should be the length of the slit? A. About $\frac{3}{10}$ of an inch. 4. Should the lens in the collimator tube be achromatic? A. It is not essential: but the lens must be free from spherical aberration.

(33) A. W. asks: Of what size and how far from an objective, consisting of 3 plano-convex lenses of $\frac{3}{16}$ inch focal length, should a diaphragm be? A. That can only be determined by trial. Some objectives do not require any diaphragm.

(34) B. C. says: 1. I wish to make a magic lantern. Can you tell me the best size of lenses to use, both condensing and objective, to throw a picture on a screen from 10 to 30 feet away? A. Use 4½ inch condensers with objective of 1¼ inch aperture and 6 inches focal length. 2.What change is made in the lenses to throw the picture farther away? A. Only a change of focus. The farther away, the larger the picture. 3. Do the burner and the centers of the lenses require to be in line? A. Certainly.

(35) J. C. W. asks: What has become of the Keely motor? I hoped that there was something in it, as, allowing for large exaggerations, I did not think it possible that lawyers or men of standing in society could or would suffer their names to go forth to the world in connection with a humbug of such magnitude. What has become of it? A. Echo answers: What?

(36) E. asks: Is it possible by the use of prisms to so decompose or separate the prismatic rays of light as to enable the photographer to take pictures in colors? Chromos were first made by adding one color at a time. Why may not the rays of the camera be tinged by passing through media of prismatic colors superimposed on each other? Experiments in this direction will, I believe, yet solve the problem which has so long baffled photographers. A. The difficulty in photographing colors is not in the manner of lighting the subject, but in the fact that the photographic chemicals are insensitive to all colors except the blue and violet.

(37) M. J. M. says: I have a small stream of water carrying about 20 cubic feet per minute, in which I can obtain a head of not over 2 feet. Can I raise with such a head water enough for family use, with an hydraulic ram, to the hight of about 20 feet, say about 10 or 15 gallons per hour? A. This should be done without difficulty.

What is the rule for setting thimble skeins on axles? A. Perhaps some of our readers will give this correspondent the benefit of their experience.

(38) F. G. asks: 1. Is there any work in the English language that gives formulæ for grinding and arranging the lenses in modern compound microscopes? A. "The Microscope and its Revelations," by Dr. W. B.Carpenter. They are ground like all other lenses. 2. Can I get optical glass, both crown and flint, of uniform refractive power, whose index of refraction has already been ascertained with sufficient accuracy on which to calculate the curves of lenses without testing each piece separately? A. We do not think you can; but you can get glass of known specific gravity, which will enable you to form some idea of its quality.

(39) E. L. H. says: We differ on ventilation under the roof. One wants to ventilate directly through from the gable ends. I want ventilators in the ceiling, constructed so that they can be closed when desired,with an escape out through the steeple. Which will be the best? A. Your plan is the best; but it is also necessary to have openings near the floor as a part of a good system of ventilation. Theseshould be arranged so as to prevent drafts as much as possible.

(40) E. L. H. asks: Are we to understand that you are opposed to arched ceilings for churches? We are building a church which is to be 50 x 76 feet x 35 feet, ceiling to be arched, having a spring of 9 feet, and paneled, commencing at the spring of the arch. The ribs forming the panel will be 24 inches deep. It will require some 5 or 6 of these ribs to give the desired finish, forming continuous panels from spring to spring of the arch. We desire your opinion. A. It is true that arched ceilings have proved to be subject to echoes more than those of other forms, but this seems to be governed somewhat by the hight of ceiling, low ceilings being apparently more subject to them than high ones. An arched ceiling is more objectionable still, on account of its tendency to thrust out the side walls and thus to cause a settlement. This has occurred in many cases where the buttresses were insufficient or entirely wanting, and where no tie rod or beam extended across the church at the eaves.

(41) H. C. D. asks: In making malleable cast iron it is melted in an air furnace. When it is put in, it is a gray cold blast charcoal iron. It remains there until it changes from gray to white. Does it contain more carbon when it is white than when it is gray? I think it does, for ir it remains in a little too long it becomes steel, which we can take to the blacksmith's fire, and draw and temper. A. The white contains the least carbon.

(42) G. L. P. Jr. asks: 1. Where can I get information as to making models and patterns for casting small steam cylinders and other articles? A. Consult our advertising columns. 2. What should be the length and breadth of ports, measuring on the cylinder face, of a cylinder, the bore of which is 2¼ inches and the stroke 4½ inches? A. Make your cylinder steam ports ¾ long and ⅛ inch wide, the exhaust port ¼ wide, and the bridges between the ports ⅛ wide. 3.What should be the size of the slide valve for same cylinder? A. Valve ⅞ wide, with an exhaust port barely ⅛ nch wide.

(43) R. C. asks: At how many revolutions per minute can we run a grindstone 6 feet in diameter with 8 inches face, with perfect safety? A. You may run it safely at 300 revolutions per minute.

(44) M. R. asks: 1. How old is the earth according to geology and astronomy? A. The age of the earth cannot be fixed, as its proved antiquity is so great that many cycles of ages, more or less, are of little consequence. 2. How long has it been since man made his first appearanee on the earth? A. No one knows. The answer to the previous question applies to this one also.

If on a solid wheel, 4 feet in diameter, the point half the way (or 1 foot) from the center travels through only half the space in the same time that a point furthermost from the center does, is there not good reason to believe that there is a point in the center that does not move at all? A. There is in every rotating body, theoretically, a point of no rotatory motion. But it is a point, "without parts or any magnitude."

(45) H. H. A. says: I have a pump with 1¼ inch suction and 1 inch discharge pipe. At a very low speed it works well; but with full head of steam, it does not half fill the pump, and thumps badly. Is the suction pipe large enough? A. No. Make it 2 inches in diameter.

(46) W. F. S. asks: 1. Of what alloy shall I make a lead wheel on which to polish cut flint glass stoppers? A. Use old type metal. 2. How will I prepare the rottenstone to use with it? A. You had better purchase it already prepared. The back numbers you ask for are out of print.

(47) A. asks: Please inform me of the rule for determining the diameter of a wheel when number of teeth and pitch are given. A. Multiply the number of teeth by the pitch on the pitch line, and divide by 3 1416. The quotient is the diameter at the pitch line.

(48) J. E. H. asks: How is it that telegrams can be sent two ways over one wire at the same time? A. The instruments are so arranged that the current sent does not affect the receiving instrument of the station sending. This is effected in various ways. One of these consists in winding the magnets with double coils, the convolutions of which are put on oppositely; or the connections are so made that the result amounts to the same thing. One end of one coil is connected to the line wire: one end of the opposite coil, to the ground, through a resistance equivalent to that of the line; and the other ends of the coils are joined together. The junction is then connected to the transmitting apparatus. When a current is sent out it divides where the two coils meet, half passing through one coil to the line, the other half, through the opposite coil and resistance, to ground. As the half currents are oppositely directed in the two coils, the action of one neutralizes that of the other, and the iron cores remain unpolarized. The half current which goes to line passes on to the receiving instrument at the distant station, and, if the key at that point is open, goes through one coil of the instrument, thus producing a signal. There may also be a time, in simultaneous transmission, when the received half current passes through both coils of the home instrument. It will be observed, however, that, for such a case, the convolutions of the coils supplement each other; but at the same time, the current must pass through the extra resistance,so that while the number of convolutions is doubled, the current is reduced one half by this added resistance, and thus the effect remains as before.

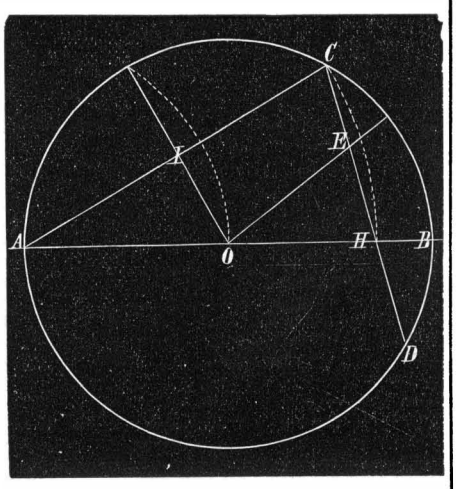
(49) A. I. says: Please give me a recipe for making the black composition that picture frame moldings are coated with. It is afterwards easily polished with a rubber to a jet black. A. Make your frames of plaster of Paris mixed with thin glue water. When dry, cover them with size and lampblack, and varnish with the following composition: Boil turpentine until it becomes black, and sprinkle on it 3 parts amber in fine powder to 1 turpentine. When the amber is melted, add some sarcocolla and more spirit of turpentine, and stir the whole. Strain the mixture, mix with ivory black, apply in a hot room to the plaster frames, and place in a heated oven. Two or three coats will be necessary.

(50) G. P. S. says: I have a zinc and carbon battery, the carbon plates of which are supported by copper connections. I find that the acid creeps up on these connections and corrodes them. What can I use to prevent the corrosion? A. The best plan is to deposit copper on the end of the carbon and then solder a wire to the deposit. First heat the end of the carbon and touch the part just beyond where the copper is to extend (about half an inch from the end) with a piece of paraffin, taking care it does not run up the part to be deposited on; should it do so, however, it may be driven off by a strong heat. When cold, cut a few scores in the surface to give a hold to the copper, and drill a hole through, in which fix firmly a copper wire projecting on each side. With a warm iron,spread a good film of paraffin from the line of intended coppering as far down the carbon as the part to be immersed in the liquid of the battery when working. Connect a wire to the carbon, by a screw clamp, and insert in a copper solution, arranging at first for a quick deposit. When a good deposit is made, drill a few holes right through copper and carbon, soak in water to remove any absorbed copper salt, and dry it thoroughly. Now tin the part to which the connecting wire is to be soldered and stand the carbon with its coppered end in melted paraffin till its upper part is well saturated. When the connection is soldered, a coating of paraffin may be spread with an iron over the copper and all parts of the carbon not intended to be acted on by the liquid.

(51) J. M. W. says: 1. It is universally accepted that a current of electricity on a wire is only complete when the metallic circuit is complete, and that a wire of 400 miles in length in reality is 400 miles of electricity. What becomes of the charge when the circuit is broken? Does it return to the battery and replace itself as before starting out upon its journey? This does not seem possible when we consider the amount of surface in both battery and wire. For instance, the surface of 400 miles of wire exceeds many times that of a battery consisting of 200 cells of gravity. What becomes of all this amount of force? A. The current circulates only when the circuit is complete; but it is not essential that the latter should be metallic. If the circuit is interrupted, when insulation is perfect, the conductor on each side of the break assumes a charge proportionate in magnitude to its surface, and its potential is equal to that of the battery.

(52) S. asks: Is there in existence a white cement for outside building purposes capable of standing the weather? A. Portland cement is probably the lightest: it is advertised in our columns. Ordinary hydraulic cement will make a light stucco by using white sand or a good lime paste with it. The lime paste may equal in volume the cement paste.

(53) H. C. N. says: I send you the following simple method of ascertaining the sides of some inscribed figures. Its simplicity will recommend it to your readers. Set off the radius, B C;



then from center, A, at distance, A C, cut off A H, equal to A C. Draw C D through H. The rest explains itself. A C is the side of an inscribed trigon, C D is the side of a square, D E the side of a hexagon, A I the side of a heptagon, O E the side of an octagon, D B the side of a dodecagon.

(54) J. M. W. says: 1. There are 9 or 10 wires feeding from two Callaud batteries; both take earth from same ground wire. If we adjust closely, we get a cross from either of the 9 wires. We did not have this trouble on same wire with an acid battery. Is this a feature of the Callaud, or is the defect at the point of junction with the ground wire, or is it in the ground wire wholly? A. No. The ground wire may be faulty; but it is more probable that defective insulation is the cause of the phenomenon. 2. Working a wire 400 miles in length, will it improve its working condition to use condensers at each terminus? A. No.

(55) J. M. W. asks: 1. Is the conductivity of a wire altered by expansion and contraction other than by tightening the connections at time of contracting? A.As the temperature rises,the conductivity becomes less. 2. In speaking of low and high resistance, is the term low used to designate resistance from 1 upwards, and high resistance the amount of interference it is capable of overcoming? A. Low and high resistance are relative terms; 1,000 ohms would be called exceedingly low resistance if it referred to the insulation of a mile of telegraph wire. 3. Common line relays are measured and marked like this: 75 ohms, 100 ohms, 130 ohms, etc. Is the one of 130 preferable to the others for intensity of attraction, and more suitable for general use? A. It would be more suitable for average telegraph lines; but these matters depend altogether upon the circuit in which the instruments are to be used. 4. I have a battery constructed as follows: The glass cell is 3 inches in diameter and about 4 or 5 inches high. In the bottom of this, I place a piece of cast iron, and suspend a disk of copper, both connected with insulated wire. I then fill up the cell with a strong solution of lye from wood and coal ashes. I get a pretty good current from it. Is it of any value? A. Very little.

(56) G. C. N. asks: Please tell me of some harmless substance by which light brown hair can be changed to a golden color. A. A dilute solution of chlor-nitric acid (*aqua regia*) applied as a hair wash will effect this. A similar preparation of peroxide of hydrogen may also be employed. But we cannot recommend the use of either. Any one who knows of a better recipe will please send it to box 773, New York city.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L. B. D.—The explosion was most probably caused by marsh gas or light carburetted hydrogen. This gas likewise forms the chief part of fire damp.—C. W. G.—It consists of oxide of iron, alumina, and silex. For anti-incrustators, see our advertising columns.—S. F. S.—It is yellow and blue clay. You might, with profit, see how it will stand heat.—D. T. G.—No. 1 consists mostly of silex, silicate of alumina, and carbonate of lime, nothing to render it more valuable than any common earth. No. 2 is a fine white clay, remarkable for its small percentage of combined water. Try its capabilities in the way of absorbing grease stains, drying up and disinfecting foul places, and similar uses. No. 3 is inspissated bitumen. You ought to be able to make use of it in manner proposed. No. 4 is rather doubtful. It contains a small percentage of oxide of iron. No. 5. The magnetite will all be swept out by a magnet, and the rest are quartz grains and hyacinths.—The spider from Jacksonville, Fla., has been handed to a distinguished entomologist for examination.—M. P. C.—It is celluloid. See p. 23, vol. 33.

W. A. F. asks: Will some one give a plan for straightening wire, from No. 16 to No. 8?—F. A. R. asks: How can I calculate the number of bushels of shelled corn contained in a crib of any certain size, the corn being on the cob? -G. M. Jr. asks: How can I make Cologne spirit?—J. W. B. asks: How can I put a fine black finish on gun work?—J. C. W. asks: How large a cube can be cut out of a ball 12 inches in diameter?—W. J. says: I am about to construct a flouring mill. Will some one tell me the size and length of reel, and number of cloth, which will make the most merchantable flour?—L. M. H. asks: Would lin wood do for building a boat 20 feet long?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Cheap Postage. By C. E. H,
On Superseding Steam. By H. C. D.
On the Post Office Department. By J.
On Explosives. By J. N. K.
On Frost and Waste Heat. By T. P.
On Creeping Rails. By L. D. W.
On a Blowpipe. By C. H. H.
On Bone Black. By F. L. B.
On Steam Domes. By T. H.
On the Years of the Planets. By J. H.
On Electric Organs. By T. G.

Also inquiries and answers from the following:

A. K.—A. C.—A. W.—K. S. D.—E. H. C.—G. C. P. Jr.—J. F. M.—B. F. G.—A. B. P.—L. C.—J. S.—J. H. R.—J. L.—J. S. T.—J. W. G.—A. L.—W. S. B.—D. R.—W. M. W.—M. McD.—H. F, G.—E. R. G.—I. J.—W. F. W.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells machinery for making flour sacks, and paper bag machines? Who sells meteorological instruments? Who makes large weight power machines? Who makes an artificial hand, which a disabled man can attach to the stump of his fore arm, so as to carry pails, etc.?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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9,120.—PAPER CLIPS.—O. F. Fogelstrand, Kensington, Ct.

9,121.—THERMOMETER STANDS.—C. Kitschelt, N. Y. city.

9,122.—TYPES.—A. Little, New York city.

9,123.—BRACKETS.—J. P. Miller, Philadelphia, Pa.

9,124, 9,125.—INKSTANDS.—H. J. Müller, N. Y. city.

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9,127.—PERFORATED PAPER.—G. M. Jacocks *et al.*, New York city.

9,128.—RANGES.—S. H. Ransom, Albany, N. Y.

9,129.—BADGE.—A. J. Dallas, U. S. Army.

9,130.—MEDAL.—R. J. Delany, Philadelphia, Pa.

9,131.—PERFORATED PAPER.—G. M. Jacocks *et al.*, New York city.

9,132.—LAMP STANDS.—F. R. Seidensticker, West Meriden, Conn.

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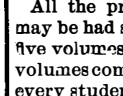

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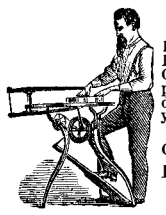

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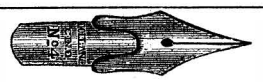
THE  BEST
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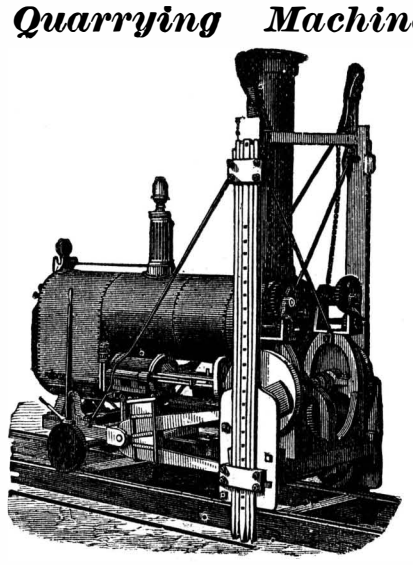

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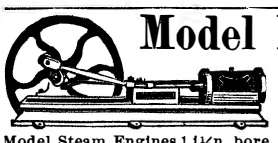

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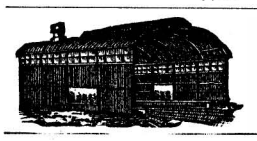

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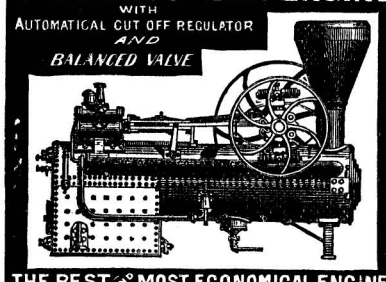

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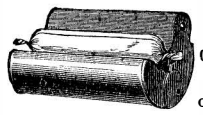

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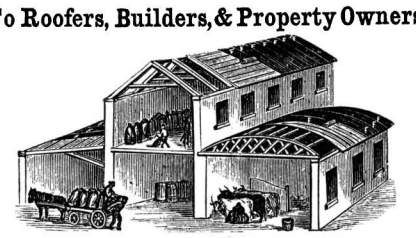

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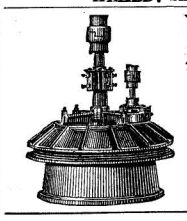

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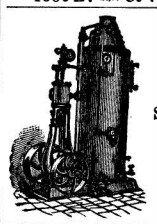

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